LITHIC TECHNOLOGY AND SOCIAL AGENCY IN LATE NEOLITHIC NORTHERN ITALY. KNAPPING FLINT AT ROCCA DI RIVOLI (VERONA, ITALY)

BY

MARTINA DALLA RIVA

A thesis submitted to the University of Birmingham for the degree of

DOCTOR OF PHILOSOPHY

Dept. of Classics, Ancient History and Archaeology
School or Art and Law
University of Birmingham
October 2015

LITHIC TECHNOLOGY AND SOCIAL AGENCY
IN LATE NEOLITHIC NORTHERN ITALY.
KNAPPING FLINT AT ROCCA DI RIVOLI (VERONA, ITALY)

BY

MARTINA DALLA RIVA

ABSTRACT

The thesis explores the relationship between late Neolithic knappers and flint resources at the settlement of Rocca di Rivoli (Verona, Italy), a key site for the understanding of the late Neolithic in northern Italy and in particular for the production and circulation of flint artefacts.

Approximately 8000 flint artefacts were recorded by means of an attribute-based relational database and subsequently analysed for the present work. The use of the chaîne opératoire method, combined with a social agency and social-anthropological theoretical approach, provided a useful framework within which to study the lithic assemblage and discuss topics such as lithic tradition, style and specialization in the context of the late Neolithic of northern Italy.

A series of characteristics peculiar to the site challenged the potential retrieval of data and subsequent interpretation. Firstly, the intrinsic nature of the site characterised by contexts of secondary deposition (i.e. pits) meant the identification of fragmented chaînes opératoires. Secondly, the poor conservation of the finds and bias in the accessibility procedures to the collection limited the choice of analytical methods to be employed. Nonetheless, significant results were obtained, which contribute to the discussion and the understanding of flint knapping during the late Neolithic.

At Rocca di Rivoli there were clear preferences in terms of raw material: flint coming from the Maiolica outcrops was by far the preferred variety to be working with. It is suggested that raw material procurement possibly took place in different ways, but that a more precise identification in terms of its organization is not possible at this stage. Rocca di Rivoli finds itself in a privileged location with good-to-excellent flint resources located at a distance between 1 and 6 km.

A total of 16 chaînes opératoires were identified at Rocca di Rivoli which represent basic frameworks allowing for endless variations and additions taking place during the unfolding of flint knapping activity. It is argued throughout the present work that knapping was undertaken by both expert and non-expert knappers, including apprentices. Some aspects characterizing the practice of flint knapping changed throughout occupation of the site (flake/blade ratio, debitage type, retouch mode, mistake rate) possibly pointing at changes in social dynamics affecting the community of Rocca di Rivoli.

ACKNOWLEDGEMENTS

I am indebted to many friends and colleagues who helped in so many different and significant ways throughout the entire, seemingly endless PhD experience.

It was the enthusiastic response from Lawrence Barfield, Paul Garwood and Laura Longo that prompted the idea of a PhD in 2005; they have been not only precious and solid points of reference for my research, but have supported me throughout the entire PhD period with their encouragement, expertise and punctual advice (from methodological to political matters).

Lawrence Barfield in particular, went to great lengths to supply adequate training and background research input in the way only he could do: patiently, painstakingly, and with passionate and constructive criticism. I am forever indebted to his teaching and to his enthusiasm, which never failed to be present, even in the very last months of his illness.

I am most grateful to Marylane Barfield, who has always made me feel at home in Blenheim Road. Her friendship, love and hospitality have been instrumental to my finishing this work. Heartfelt thanks to Marylane, Abigail and Sebastian for allowing me to share their time with their husband and father respectively, allowing archaeological discussion till the very end of his days in this world.

I am indebted to Stephen Litherland, Kirsty Nichols, Alie Creighton and Martin Weaver, and the Hunts (Sally, Andy, Evan and Molly) for their friendship and support over the years. I thank Vittorio Rioda, Giorgio Chelidonio and Claudio Isotta for having greatly contributed with their advice on sourcing and identifying raw materials. The experimental archaeology training provided by Nicola Dal Santo, and his familiarity with Neolithic lithics of northern Italy, have been pivotal in understanding key issues of my research.

My gratitude goes to Anna Angelini and Natasha De Bruin for their advice on lithic analysis; to Fabio Candura and Eamonn Baldwin (fieldwork GIS), Alessandro Gloder (photos), Paolo Giunti (drawings), Emanuele Ferri and Marco Predicatori (database) for their expert advice. Patti Rucidlo and Martino Traxler were extremely patient in helping with editing part of this work.

Thank you to Paul Garwood for commenting on earlier versions of this thesis and to Giorgia Castro for help with the formatting; I could not have done it without them.

I am thankful to the University of Aix-en-Provence, in particular to Maxence Bailly who provided me with a wonderful opportunity to attend a two-week seminar in 2008 on prehistoric technology.

This experience greatly contributed to my training and research, not only in terms of teaching and bibliographical resources, but also by providing an important occasion to receive feedback from Maxence and colleagues in the department (in particular H. Plisson).

I am grateful to Mirco Campagnari, former mayor of Rivoli Veronese, his partner Stefania Testi and the staff there, for believing in this work from the start, and for helping secure funding for research and outreach projects in the area, which contributed towards building a strong relationship with Rivoli Veronese and its archaeology.

I should also mention Alessandra Aspes (former director of the Museo Civico di Storia Naturale of Verona) and Luciano Salzani (formerly responsible for the Nucleo Operativo, Soprintendenza per i Beni Archeologici in Verona); their lack of support for my work and refusal to allow me to access the material objects of my research for two years helped me develop important life skills such as diplomacy and patience, and to perfect the art of formal letter writing. Submission after all these years and obstacles makes it even more worthwhile.

Finally, to my family: Alfonso, Davide, Elena, Leonardo and … thank you for putting up with me working silly hours and often being stressed about 'some stones'. It is finally done and this is for you.

All that is written here is my work and arguments, with the exception of where they are acknowledged. I am therefore solely responsible for what is written in the following pages, including mistakes. This work amounts to 78,200 words.

Martina Dalla Riva
Rome, 28th Oct. 2015

Contents

List of Figures

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Fig. 4.23. Examples of sharpening on simple burins. 1: burin with a single burin facet, no visible sharpening; 2: sharpening by successive burin blows on the same point; 3: sharpening by parallel removals; 4: sharpening on both burin facets of a dihedral burin; 5: sharpening by truncation and application of a new burin blow on the opposite edge (from Inizan *et al.* 1999, fig. 79).

Fig. 4.24. Tranchet blow with resulting characteristic waste product (from Inizan *et al.* 1999, Fig. 34, 1a).

Fig. 4.25. Microburin blow technique. Production scheme of a microburin (4a) and a piquant-triédre (4b) by percussion or pressure on one edge of a blade resting on an anvil (1, 2, 3). Using this technique to obtain a backed blade with a distal (5) or proximal (6) piquant-triédre, a trapeze , a crescent or a triangle (7, 8, 9). 10: production of a triangle and a trapeze on the same blade; from top to bottom: distalmicroburin, triangle, double microburin, trapeze, proximal microburin (modified from Tixier *et al.* 1976, Fig. 16 and Inizan *et al.* 1999, Fig. 33).

Fig. 4.26. Clactonian notch technique and waste product (from Inizan *et al.* 1999, Fig. 34, 4).

Fig. 4.27. Fig. 4.27. Examples of oblique parallel retouch covering both artefact surfaces. Left: obsidian (J. Tixier). Right: heat-treated Grand-Pressigny flint (D.E. Crabtree). (Atelier photo C.N.R.S. Meudon, reproduced in Inizan *et al.* 1999, Fig. 71).

Chapter 5

Fig. 5.1. Left: stratigraphical sequence of main geological formations in the Lessini Mountains. Right: examples of flint varieties from flint bearing geological formations. (left, from http://spotidoc.com/doc/730904/an-introduction-to-the-geology-of-the-lessini-mountains-area. Right: courtesy of Progetto S.E.L.C.E.).

Fig. 5.2. Flint types from the Maiolica formation (loc. Mount Crubbio) (from Isotta & Zanini 2008, Fig. 2).

Fig. 5.3. Flint types from the Maiolica formation (loc. Orsara, Grezzana) (from Isotta & Zanini 2008, Fig. 3).

Fig. 5.4. Flint types from the Scaglia Variegata formation (loc. Molina, Grezzana) (from Isotta & Zanini 2008, Fig. 4).

Fig. 5.5. Flint types from the Scaglia Variegata formation (loc. Colombara Pellegrini Romagnano) (from Isotta & Zanini 2008, Fig. 5).

Fig. 5.6. Flint types from the Scaglia Rossa formation (loc. Pesa di Romagnano) (from Isotta & Zanini 2008, Fig. 6).

Fig. 5.7. Flint types from the Scaglia Eocenica formation (loc. Mount Loffa, Sant'Anna d'Alfaedo) (from Isotta & Zanini 2008, Fig. 7).

Chapter 7

Chapter 8

Chapter 9

List of Tables

Chapter 7

Chapter 8

Table 8.10. Amount of cortex surviving on flake cores from Rocca di Rivoli.

Chapter 9

List of Abbreviations

Text

MASL	*metres above sea level*
ID	*Identification code*
RC	*Rivoli Castelnuovo*
VBQ	*Vasi a Bocca Quadrata*

Bibliography

AA	*American Antiquity*
AF	*Annali dell'Università di Ferrara*
APAAA	*Archaeological Papers of the American Anthropological Association*
BAR IS	*British Archaeological Reports, International Series*
BPI	*Bullettino di Paletnologia Italiana*
BSPF	*Bulletin de la Société préhistorique française*
CUP	*Cambridge University Press*
IIPP	*Istituto Italiano di Preistoria e Protostoria*
JAMT	*Journal of Archaeological Method and Theory*
JAS	*Journal of Archaeological Science*
MMCSN	*Memorie del Museo Civico di Storia Naturale di Verona*
NAA	*North American Archaeologist*
PA	*Preistoria Alpina*
PPS	*Proceedings of the Prehistoric Society*
RSP	*Rivista di Scienze Preistoriche*

Chapter 1

INTRODUCTION

Lithic artefacts have accompanied human beings for the vast majority of their existence: from their beginnings (McPherron *et al.* 2010) until very recently (e.g. Bordaz 1969; Runnels 1994; Woodall & Kirchen 1999). In addition, flaked (also knapped or chipped) lithic artefacts are without doubt the best preserved and most abundant archaeological finds unearthed at prehistoric sites. For these reasons, lithics represent one of the most important sources of evidence for understanding prehistoric life and, understandably, archaeologists have spent considerable time and effort in trying to make sense of such abundant material.

For the Palaeolithic period, in particular, lithic artefacts have often been held to be the key to the long-term study of hominid intelligence and cultural capacity (e.g. Ingold 1993; Noble & Davidson 1996: 190-205; Stout *et al.* 2000). In the case of later prehistoric lithic assemblages, however, archaeologists have only recently gone beyond typological and functional analysis, usually employed as a means to interpret prehistoric economies. There is now increasing interest in lithic tool production, implementation and final discard as instrumentally significant for understanding the social behaviour and organisation, cultural choices and belief systems of prehistoric communities. Such an approach is the product of a well-developed theoretical standpoint which views artefacts as containing, in their very substance, messages about their past purpose and significance in relation to the human beings who produced, used, exchanged and abandoned them (e.g. Hodder 1982a, 1982b).

Within this framework (which will be explored and discussed at length in Chapter 2), both technological development and variation play a fundamental role. The study of techniques and technological organization provides significant insights into the unique relationship between human beings (as a group and as individuals) and their surrounding material world, and how the latter is incorporated and negotiated into different aspects of material culture. At the same time, whereas methods for developing an understanding of an artefact's function(s) are well-known and universally shared, such as use-wear analysis combined with experimental work (e.g. Semenov 1964; Juel Jensen 1994; Longo *et al.* 2000-2001), less explored are aspects relating to the value and meaning of objects. This might be due to the fact that the theoretical basis for addressing such topics has only recently been set (Schofield 1995: 3) and that appropriate methodologies (e.g. the *chaîne opératoire*) have yet to become universally accepted.

The latter is particularly true of Italian later prehistoric lithic studies (from now on, unless specified otherwise, the term "lithic studies" will be synonymous with "later prehistoric lithic studies";

i.e. Neolithic-Bronze Age) which have, in general, lagged behind contemporary heuristic approaches widely adopted and shared elsewhere in Europe, in favour of a more traditional typological approach. This remains largely the case despite a few significant exceptions (e.g. mostly works by Dal Santo, the merits of which will be discussed in the following pages). At the same time, stone tool typologies have consistently played a secondary role in Italian later prehistory, over-shadowed by those based on ceramics, which are believed to provide better diagnostic attributes for dating purposes. As a result, for a long time, the prehistory of lithic tools on the Italian peninsula has been based on typological differences and similarities, rarely going beyond the quantification and description of the material recovered.

The overall picture is naturally more complex. At this stage, however, I wish to point out that this thesis, from its inception, reflects the author's need to break away from the traditional typological approach to explore lithic artefacts in relation to the people who produced (used, exchanged and discarded) them. Questions such as "Where was the raw material coming from?", "How was procurement organized?", or "How was knapping carried out (in terms of both technique and work organization)?", are only a few of those which I attempt to answer here; as well as questions concerned with more general issues relating to technological choices, symbolism, resource control, specialization, knowledge transfer, establishment of a tradition, etc. Such issues are at the heart of lithic studies and their definitions are being constantly re-forged thanks to developments at both theoretical and methodological levels in archaeology and in related disciplines, especially cultural and social anthropology, social sciences and material culture studies.

There is little doubt that the most important development in the field of lithic studies has been the introduction of the concept of the "*chaîne opératoire,*" literally "operational chain" or "sequence," which refers to "the range of processes by which naturally occurring raw materials are selected, shaped and transformed into usable cultural products" (Schlanger 2005: 25). It was first defined by Leroi-Gourhan (1964, 1965), although it was already implicit in the technological work of Marcell Mauss (e.g. 1936). The *chaîne opératoire* idea enabled Leroi-Gourhan (e.g. Leroi-Gourhan & Brezillon 1966) to develop a heuristic approach to the study of prehistoric human beings and their material culture (Audouze 2002: 281). His works (Gourhan 1943, 1945, 1964, 1965), along with more recent contributions by Pierre Lemonnier (1983, 1993) and Anne-Marie Dobres (2000), are the main sources of inspiration driving the research for this thesis.

I applied the *chaîne opératoire* method to the study of approximately 8000 artefacts of the late Neolithic lithic assemblage from Rocca di Rivoli (Verona, Italy). This analysis comes at a time, in Italy, when the integration of the traditional typological approach with new ideas and methods is essential for lithic studies, as is the need to go beyond the description of the artefact *per se* in Italian prehistory. The assemblage from Rocca di Rivoli represents a very challenging case-study, for reasons which are outlined below.

Rocca di Rivoli is widely recognised as a key site for the understanding of the final period of the Neolithic of northern Italy and especially the transition from the middle to the late Neolithic in the area. Although C14 dates produced in the 1970s (see Appendix 1) for the site were once referred to as "unreliable" (Visentini *et al.* 2004: 139), the Square Mouthed Pottery typology based on the Rocca di Rivoli assemblage (Barfield & Bagolini 1976: 20-53) still remains the key point of reference for more recently discovered sites. In addition, its geographical location with regard to flint outcrops in the area, as well as to ancient traffic routes, the abundance of lithic artefacts (amounting to *c.* 200kg for the excavations undertaken between 1963 and 1968) and the multi-period occupation of the site (from the middle Neolithic to the late Bronze Age), offer a wide range of avenues for exploring lithic artefacts in relation to the issues briefly noted above. Finally, it should be pointed out that excavations at Rocca di Rivoli took place in the 1960s, when the majority of the questions I consider in this work were not even being formulated within the scientific community. On this point, it would be challenging, as well as informative, to see how far the approach and methods adopted here can go, despite the limitations posed by the extant excavation records and bias in the recovery of the finds.

From a strictly Italian perspective, this thesis represents, in many ways, a new kind of approach to lithic studies. However, it is important to recognise that in wider terms this work is very similar to and shares both theoretical and methodological frameworks with publications by European colleagues. The results presented here will hopefully prompt a dialogue between those studying Paleolithic and later prehistoric flint assemblages in Italy, in order to finally consider, from a diachronic perspective, the technological development of this area. I hope that this work, at the very least, results in the beginning of a much needed debate within Italian prehistory, and in later prehistoric lithic studies in particular, which takes into consideration prehistoric people and their actions.

The remaining part of this chapter will briefly introduce the site of Rocca di Rivoli and the work undertaken there during the 1960s. This is followed by a survey of the middle and late Neolithic of north-eastern Italy and what we know about lithic artefacts of this period. Finally, a brief overview of Italian later prehistory lithic studies is presented, followed by the objectives of the present work and a brief plan of this thesis.

Rocca di Rivoli

Geography & Geology

Rocca di Rivoli, north of Verona (Fig. 1.1), is a limestone promontory (265 MAMSL) dominating the northern end of the Chiusa di Ceraino gorge (Fig. 1.2), through which the Adige River flows out from the foothills of the Alps towards the town of Verona and the Po Plain. The western

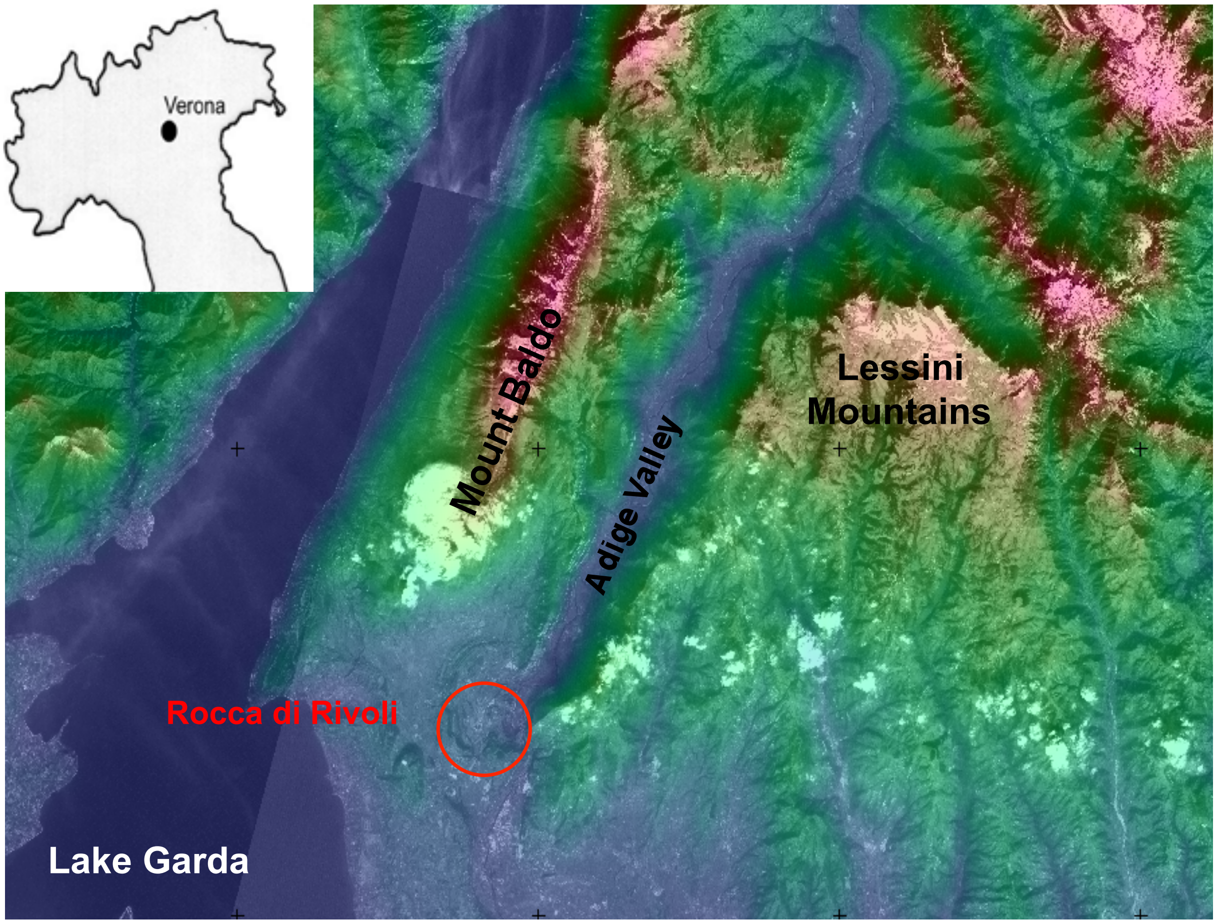


Fig. 1.1. Northern Italy and location of Rocca di Rivoli, north of Verona (source: courtesy of Progetto S.E.L.C.E.).

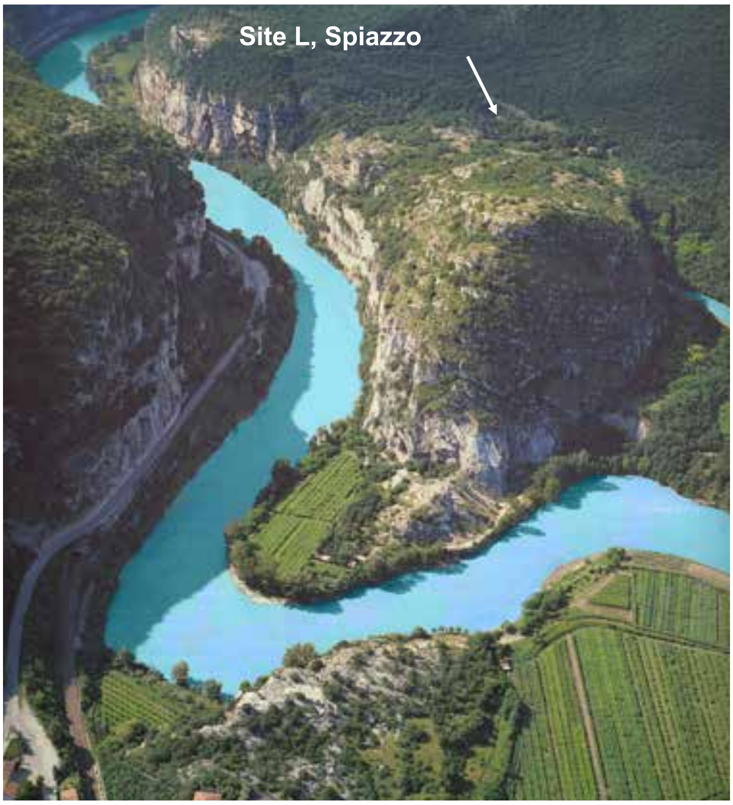


Fig. 1.2. Aerial view of Rocca di Rivoli and location of Spiazzo field or Site L (source: courtesy of J. Tappeiner, from Turri & Ruffo 1992, Fig. p. 52).

and northern sides are steep but often broken by ledges, whereas the eastern side drops almost perpendicularly into the Adige river. To the south, the hill slopes away more gently, with a series of flat areas (karstic *dolina*).

Flanking the eastern side of the gorge is Mount Pastello, the westernmost peak of the Lessini Mountains (part of the pre-Alps range reaching up to 1800 MAMSL). To the west, in contrast, the landscape is characterised by a small end-moraine, also known as the "amphitheatre of Rivoli Veronese" (Fig. 1.3), closely connected to a bigger moraine at the southern end of Lake Garda.

Fig. 1.3. Morainic Amphitheatre at Rivoli Veronese (modified from Rioda 2010).

To the north are a series of mountain ranges leading to the Alps and the Alpine passes of Val Pusteria, Resia and Brenner, of which Mount Baldo, to the north-east, represents the westernmost part, flanking the eastern side of Lake Garda.

From a geological viewpoint, Rocca di Rivoli is one of the most ancient reliefs in the area, comprising a solid block of Oolite di San Vigilio (the uppermost layer of the Jurassic rock formation known as "Gruppo di San Vigilio") (Rioda 2010), deeply marked by the action of the ancient Adige glacier. The rock formation is rich in flint on both Mount Baldo and the Lessini Mountains, where it is present with thick layers of up to 200m (Sturani 1964), although on the Rocca there is no trace of naturally-occurring flint outcrops. On the southern part of the Rocca, on top of the Oolitico di San Vigilio, lies a different rock formation called Rosso Ammonitico, which had been quarried away until the discovery of the prehistoric deposits by L.H. Barfield in 1961 (Barfield & Bagolini 1976: 1). This rock formation also does not include any flint nodules on the Rocca (since only its lowest layer, which does not contain any flint nodules, outcrops here; Rioda pers. comm. 2008).

The surrounding landscape is characterised by the by-products of glacial action (moraine deposits) and fluvial activity (alluvial terraces), and a series of geological formations surfacing in complex patterns within the surrounding mountain ranges (Venzo 1961). For the purpose of

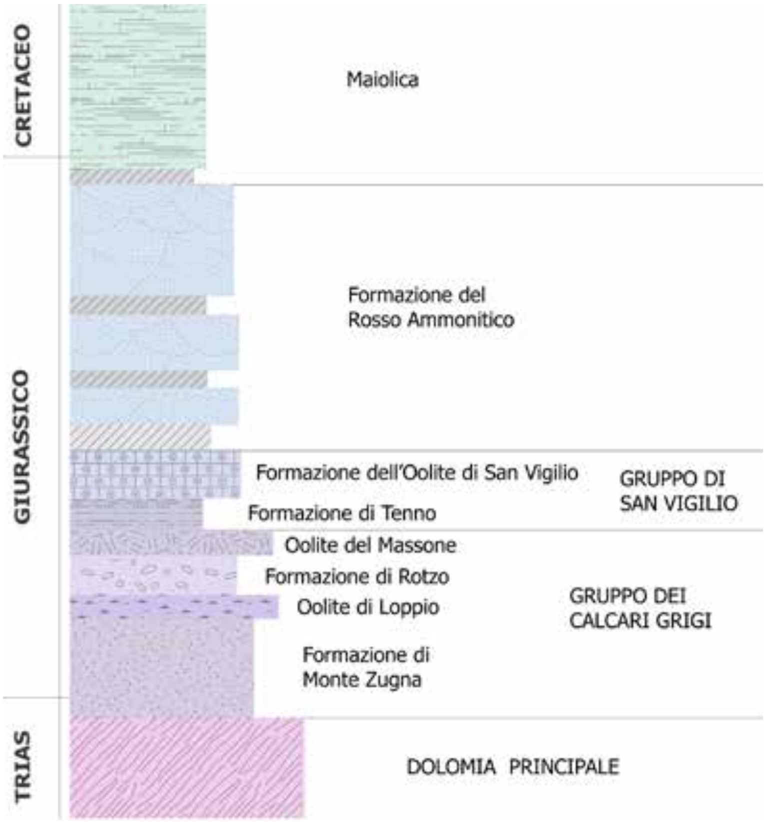


Fig. 1.4. Schematic representation of flint formation in the Verona area (modified from Rioda 2010).

the present work, attention concentrated on the geological formations bearing flint nodules; the sequence of which is schematically represented in Figure 1.4. The area around Rivoli, immediately to the east (Lessini Mountains) and to the west (hills such as Mounts Corniolo and Le Salette and the higher Mount Baldo), is naturally rich in flint outcrops which have been exploited from the lower Palaeolithic, throughout prehistoric and historic times, up to the 19th century (e.g. Bagolini & Nisi 1976a, 1976b, 1980, 1981; Barfield & Chelidonio 1992-1993; Chelidonio 2000; Longo & Zanini 2004).

History of research

Archaeological discoveries (Pellegrini 1875; De Stefani 1885; Malavolti 1951-1952; Barfield & Bagolini 1976; Hudson & La Rocca Hudson 1982), as well as historical sources (some of which are published in Cristini 2007) suggest that Rocca di Rivoli occupied a strategic position for controlling major traffic routes linking central Europe to the Mediterranean through the main Alpine passes (Resia, Brenner and Val Pusteria), since prehistoric times. The area has yielded abundant evidence of constant human occupation from the middle Neolithic (Rocca di Rivoli: Spiazzo and Campetti), through the Eneolithic (Rocca di Rivoli: Covoli della Rocca), Bronze Age (Rocca di Rivoli: Spiazzo and Regano rockshelter), Iron Age (Castello di Rivoli) and the Roman and Medieval periods (Castello di Rivoli and Rocca di Rivoli). Roman legions, medieval armies, and French and Austrian soldiers, marched through this area and fought here, changing the course of history (perhaps the most famous battle being the battle of Rivoli, which Napoleon fought and won in 1797 in the village of Rivoli Veronese).

The earliest archeological explorations on Rocca di Rivoli were carried out between 1874 and 1875 by Gaetano Pellegrini, a pioneer in prehistoric research in the area. He identified four different sites on the Rocca (Pellegrini 1875), which he partially excavated: Regano rock shelter, Covoli della Rocca, Campetti and Spiazzo. From the area called Spiazzo, a naturally sheltered dolina field, he recovered a large quantity of flint artefacts. Rather than counting the artefacts he decided to write down their weight of “kg. 76 […] to which need to be added approximately one hundred cores”; Ibid. 28) which led him to interpret the site as an “Officina preistorica di armi e utensili in selce” (a “Prehistoric workshop for [the manufacture of] flint weapons and tools”).

Pellegrini developed an outstanding research methodology for the time and his 1875 publication, accurately presenting archaeological strata and artefacts as well as soil analysis, set high standards for the fast developing discipline of prehistoric studies. At the time, Rocca di Rivoli was the first Neolithic settlement to be excavated in the Veneto (Barfield & Bagolini 1976: Foreword). Some of the artefacts recovered by Pellegrini on the Rocca were displayed in Rome at the national museum of Ethnography and Prehistory (founded in 1876 by Luigi Pigorini), and were studied by Lawrence Barfield in 1961 (Barfield 1965, 1966). Later on that year, Barfield climbed up the Rocca di Rivoli to discover that the prehistoric deposits described by Pellegrini were being destroyed by quarrying activities (Barfield & Bagolini 1976: 1).

Systematic excavations took place, for the first time under the direction of L.H. Barfield in 1963 in a number of areas on the Rocca (Fig. 1.5a) (Barfield & Bagolini 1976: 1). Between 1965 and

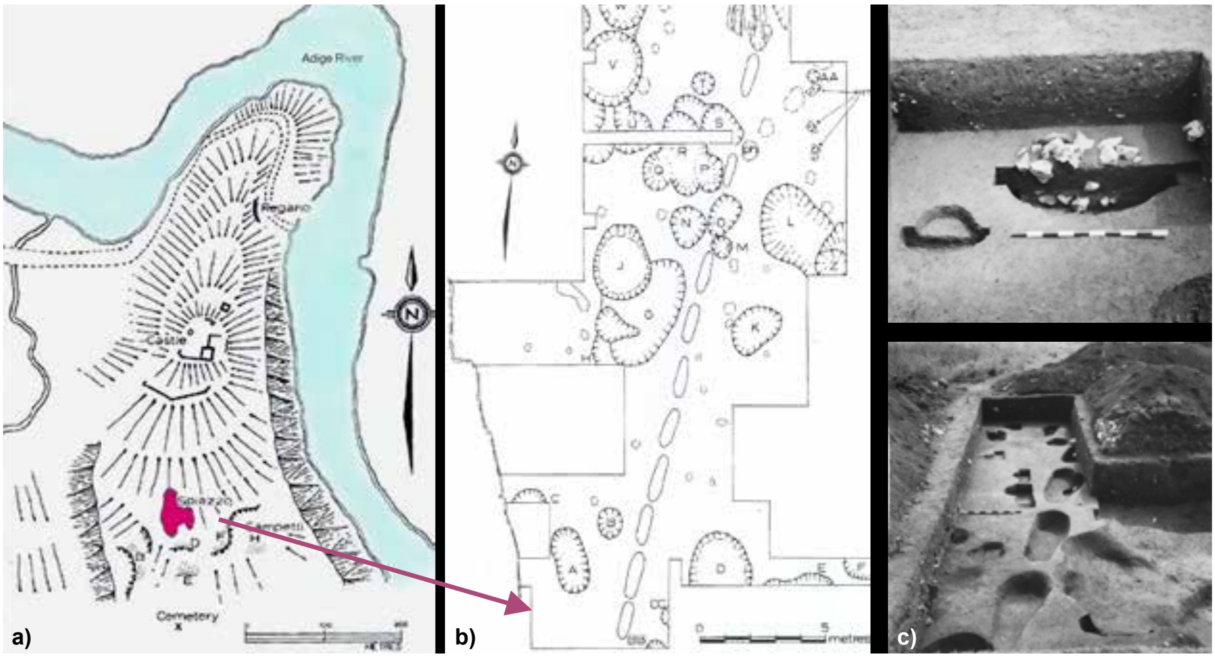


Fig. 1.5. a) Plan of Rocca di Rivoli with the location of the excavated sites 1963-1968 (modified from Barfield & Bagolini 1976, Fig. 2); b) Plan of Site L with the Neolithic pits, interrupted ditch and post holes (from Barfield & Bagolini 1976, Fig. 5); c) Excavation of pits and pit alignment (Barfield Rocca di Rivoli excavation records) (Rocca di Rivoli excavation records).

1968 the main focus became a large dolina field (200m2 approximately), known as “Spiazzo” or “Site L”, located on the southern slope and partially investigated by Pellegrini in the 19th century. Twenty-nine pits, stone levels, an interrupted ditch, post-holes, remains of hearths and daub concentrations were brought to light along with large quantities of finds, especially lithics (knapped flint artefacts, polished axes and quern stones), pottery and clay artefacts as well as animal bones (ibid.) (Figs. 1.5b and 1.5c).

Culture and Chronology

Throughout this essay, the word “culture”, unless otherwise specified, refers to “a group of stylistically related assemblages” (Hodson 1980: 7). In the case of the Italian Neolithic, this is identified and defined mainly on the basis of pottery styles.

A closer look at the chronological data available for Rocca di Rivoli i salso mandatory at this stage as C14 dates available undoubtedly affect subsequent analysis and interpretation of the evidence recovered at the site.

The 1965-1968 excavations at Rocca di Rivoli, produced a series of radiocarbon dates which placed the likely occupation of site “L” (or ‘Spiazzo’) between 4360 and 3690 cal. BC (Skeates 1994: 180, 182). At present, the chronological subdivision published by Barfield (Barfield & Bagolini 1976) is still valid, although Visentini and colleagues (Visentini et al. 2004: 139) in one of the earliest synthesis on the middle to late Neolithic of the region, are reluctant to include the dates from Rivoli (for a discussion of the dates from Rocca di Rivoli see Appendix 1).

The Italian Neolithic

The Neolithic period in Italian prehistoric studies covers several broad phases with considerable regional variation, and is traditionally subdivided into early, middle and late (or final). Criteria for these subdivisions, as Malone pointed out (2003: 242), are poorly specified and almost exclusively based on changing pottery styles, which also vary from region to region, rather than absolute chronologies (Skeates & Whitehouse 1994).

The rarity of C14 dates (and therefore of controlled chronological sequences) makes it difficult to draw comparisons among regions and understand rates of change within each region as well as the whole peninsula.

The distribution of the different Neolithic groups between 6000 and 3800 cal. BC, as shown in Figures 1.6 to 1.11 and Table 1.1, provides a schematic overview of the Italian Neolithic.

In general, it can be observed that by the middle and late Neolithic (Fig. 1.9), fewer cultural entities occupied wider areas, unifying a previously fragmented variety of cultural groups (Fig. 1.8). This pattern also characterises the final phase of the Neolithic (ca. 4000-3800 BC).

It is not the scope of the present work to review the Neolithic of the Italian peninsula, instead, the main focus of the present work is the late Neolithic period of northern Italy, which is the cultural and chronological context for Rocca di Rivoli.

In Northern Italy (Fig. 1.12), prehistoric studies have their origins at the end of the 19^{th} century. However, one has to wait until the mid-20^{th} century for the development of broad chronological and cultural sequences (Aspes 1984; Guidi & Piperno 1992). The works of Pia Laviosa Zambotti in the 1940s (e.g. 1938, 1940) were perhaps the earliest attempts to put together an overall picture of the prehistory of the Italian peninsula. It is however with the excavations at the Arene Candide cave site (Savona, Liguria) by L. Bernabò Brea (1950) that the subdivision of the northern Italian Neolithic into early (characterised by the presence of *Ceramica Impressa*), middle and late or final phases, represented respectively by Square Mouthed and Chassey-Lagozza pottery types, was established. At the same time, F. Malavolti (1951-1952, 1953-1955) developed a chronological sequence in which he ascribed Fiorano pottery to the earliest Neolithic period by noting the close similarities to the material culture of the nearby settlement at Vhò (close to Cremona). According to him, the sites of Chiozza (Reggio Emilia) and Pescale (Modena) were slightly later (middle Neolithic), whereas Remedello (Brescia) belonged to the end of the Neolithic period.

In the 1960s and 1970s, L. H. Barfield provided a chronological sequence for Square Mouthed Pottery that he applied to the whole of northern Italy (Barfield 1972). He identified three different stages of VBQ development: an early one (VBQI) called 'Finale-Quinzano', followed by 'Rivoli-Chiozza' (VBQII), and a late phase named 'Rivoli-Castelnuovo' (VBQIII), which are still valid today and are described in more detail below. He also confirmed the association of Fiorano pottery with the earliest stages of the Neolithic in the Veneto and Lombardy, but disagreed on similarities between Fiorano and Sasso material culture (ibid.).

In the 1980s and 1990s, both B. Bagolini and P. Biagi put their efforts into completing and integrating the chronology of the northern Italian Neolithic. Their arguments and models (e.g. Bagolini 1980a, 1984, 1987, 1990, 1992; Bagolini & Biagi 1985, 1988, 1990; Biagi 1991), along with those put forward by Barfield (e.g. 1970, 1972, 1987, 1999, 2000) represent the backbone of northern Italian Neolithic studies, providing a picture which, despite more recent updates (from excavations as well as research activities) and theoretical developments, remains practically unchanged to date (Pedrotti 2000; Ferrari *et al.* 2002a; Pessina & Tiné 2008).

Fig. 1.6. The earliest Neolithic evidence on the Italian peninsula ca. 6100-5800 cal. BC (from Pessina & Tiné 2008, Fig. 2a).

Fig. 1.7. The earliest Neolithic evidence on the Italian peninsula ca. 5800-5500 cal. BC (from Pessina & Tiné 2008, Fig. 2b).

Fig. 1.8. The early Neolithic evidence on the Italian peninsula ca. 5500-5000 cal. BC (from Pessina & Tiné 2008, Fig. 3a).

Fig. 1.9. The middle Neolithic evidence on the Italian peninsula ca. 5000-4500 cal. BC (from Pessina & Tiné 2008 Fig. 3b).

Fig. 1.10. The late Neolithic evidence on the Italian peninsula ca. 4500-4000 cal. BC (from Pessina & Tiné 2008, Fig. 3c).

Fig. 1.11. The final phase of the Neolithic on the Italian peninsula ca. 4000-3800 cal. BC (from Pessina & Tiné 2008, Fig. 3d).

Fig. 1.12. Geographical regions of northern Italy mentioned in the text (source: Author).

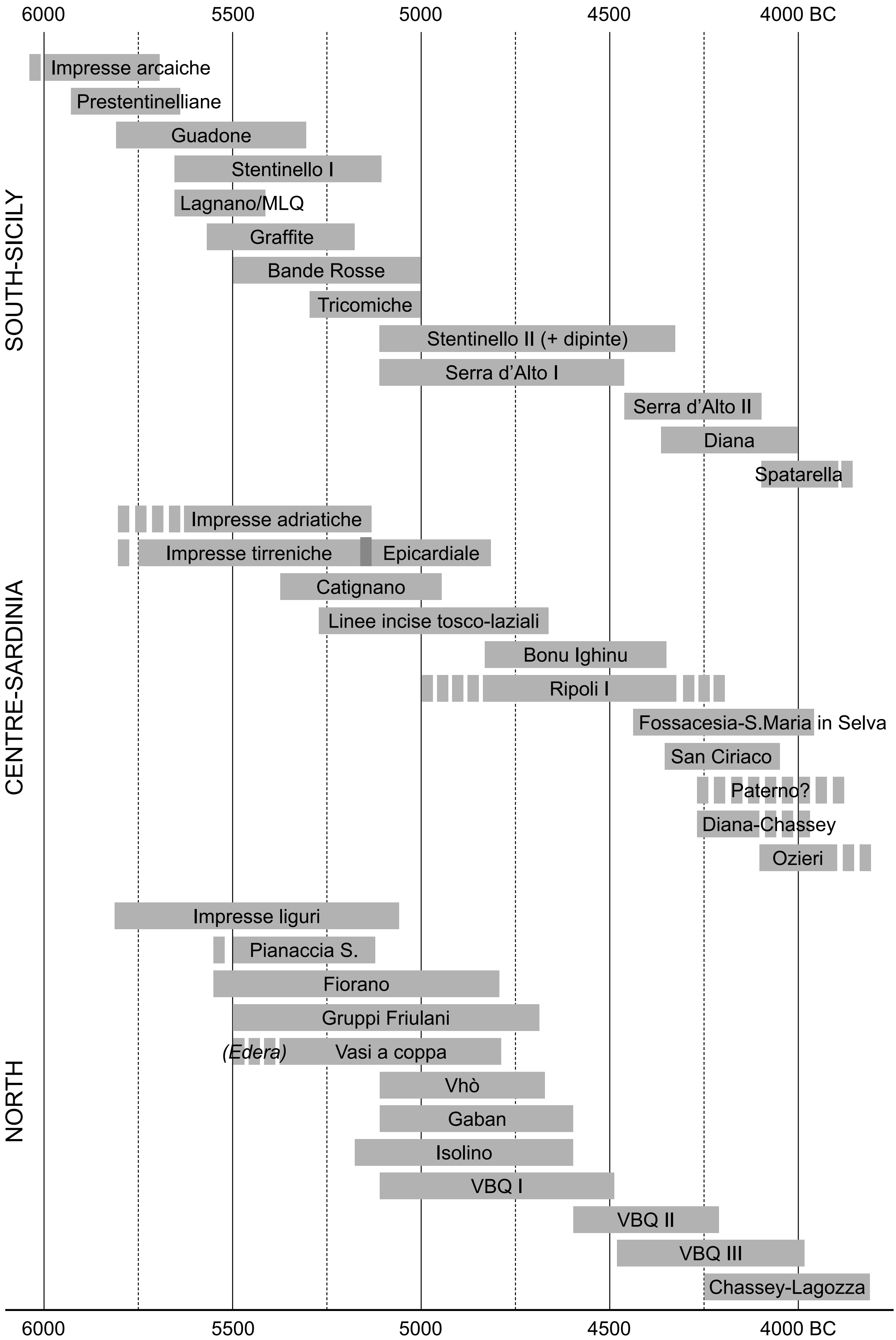


Table 1.1. Chronology of the Italian Neolithic period (from Pessina & Tiné 2008, Fig. 1).

The early Neolithic in northern Italy

Between the first half of the 6th and the beginning of the 5th millennia cal. BC archaeological evidence from the north of the Italian peninsula points at the presence of different communities characterised by distinctive material culture (Table 1.2). Bagolini (1980a: 115, 118) referred to this period as a 'mosaic' made up of different cultures, identified mainly on the basis of ceramic styles. Various explanatory models have been put forward to make sense of the concentration of different cultural groups in the area: starting from Childe's (1925) migration theory, through Ammerman & Cavalli-Sforza's (1973) 'Wave of advance' to the different mode of acculturation of local Mesolithic groups (Bagolini 1980a:118-122; Bagolini & Broglio 1985; Pedrotti 2000:124, Zvelebil & Lillie 2001).

REGION/AREA	SITE	DATING CAL. BC
western Liguria	Grotta Pollera Arene Candide	5970-5630 5960-5620 5900-5570 5850-5630 5790-5640
eastern Liguria	Cascina Cascinetta	5470-5220
Friuli	Piancada Valer Sammardenchia (1st phase) Fagnigola	5870-5480 5630-5380 5610-5380 5610-5380
Po Valley	Lovere Travo Fiorano	5970-5300 5770-5220 5670-5430
Pre-Alps	Pizzo di Bodio Alba	5470-5080 5180-4600
Adige Valley	Romagnano Loc. III	5060-4800

Table 1.2. C14 dates for the earliest Neolithic sites in northern Italy (modified from Pearce's 2013 tables 6.1, 6.4, 6.5).

The scenario was recently re-assessed by Pearce (2013), in the light of recently published data from across the Mediterranean (e.g. Biagi & Spataro 2001; Forenbaher & Miracle 2005) and thanks to online availability of C14 calibration tools (Bronk Ramsey 2009 and Reimer et al. 2013). According to him (2013: 199-207) there were a number of neolithisation processes at work throughout the 6th millennium BC and into the 5th millennium:

- Maritime leapfrog colonization (sensu Zvelebil & Lillie 2000: 62) could explain the early occupation of eastern Liguria (Grotta Pollera and Arene Candide) and the Friuli plains (Sammardenchia, Piancada, Valer and Fagnigola).
- Episodes of folk migration (ibid.) was argued for the Fiorano groups that occupied the central Po' plain.
- The gradual acculturation of hunter-gatherers was put forward for the evidence provided by the Gaban group in the Adige valley and the eastern Ligurian area (Pianaccia di Suvero).

Fig. 1.13. Distribution of VBQ sites with funerary evidence. Trentino area (Appiano, Dambel, Meano, Pederzano, Martignano and Arco - northern Adige valley - and La Vela - Trento), Veneto (Progno di Fumane, San Pietro in Cariano and Quinzano Veronese - Verona), Liguria (cave sites at Arene Candide, La Pollera, Arma dell'Aquila, Arma di Nasino, Arma del Sanguineto) and Emilia (Chiozza di Scandiano, Le Mose, Ponte Ghiara, Castelguelfo, Ponte Taro, Gaione, Benefizio, Marano, Calerno, Albinea, Rivaltella, Collecchio) (source: Author).

It is interesting to note that, the areas where a gradual acculturation of the local Mesolithic hunter-gatherers is suggested provide later dating evidence (see Table xx). In particular, it is significant that the earliest Neolithic evidence available for the Adige valley is that of Romagnano and that radiocarbon calibration provides a date coeval with those associated with VBQ groups in the area. A scenario which needs additional data to be investigated in detail, as well as new samples to be radiocarbon dating.

The middle and late Neolithic in northern Italy

In the first centuries of the 5th millennium BC, early Neolithic cultural complexity and diversity became more unified in the form of the VBQ culture. VBQ pottery has been found across a large geographical area (Fig. 1.9) from Piedmont and Liguria in the east, to Friuli Venezia-Giulia in the west, and from South Austria (Kanzianiberg; Pedrotti 1990a) to central Tuscany (Spazzavento and Neto-Via Verga near Florence; Sarti 2006). The earliest occurrence of this pottery type has been documented in Liguria, where evidence of its emergence is already noticeable in the pot types with incised decorations of the Pollera style (named after the eponymous cave site, at which this pottery type was unearthed in between contexts holding respectively Impressed ware and VBQ pottery; Tiné 1972, 1999), and in Emilia Romagna, where VBQ pottery was found in the latest horizons of sites belonging to the Fiorano culture (Pessina &Tiné 2008: 58).

From the beginning, VBQ culture was strongly homogeneous in terms of stylistic traditions, while diversified environmentally in terms of settlement location (i.e. from coastal caves to plains, from lake-side humid areas to hilltops and mountain flanks up to 1000 MAMSL) (Bagolini & Pedrotti 1998: 234). Such environmental 'adaptability' (Ibid., 235), together with a diversified economy (mainly based on herding), are held to be the most probable reasons for the successful spread of the so-called 'VBQ phenomenon' (Pedrotti 2000: 127).

The origins of the VBQ are still intensely debated (e.g. Laviosa Zambotti 1940; Bernabò Brea 1950; Barfield & Bagolini 1976; Bagolini 1980a and 1980b; Bagolini & Biagi 1985; Bagolini & Pedrotti 1998), and are exclusively explained on the basis of stylistic similarities with other European material culture finds, such as those of the Greek and perhaps Balkan spheres of cultural influence (Bagolini & Pedrotti 1998: 234-235). At the same time, although most scholars recognise the influence of strong cultural stimuli from outside the area, they are inclined to argue for local origin and development stemming from early Neolithic communities, as a number of sites in Emilia-Romagna (e.g. Rivaltella and Fornace Capuccini), Trentino Alto Adige (Moletta Patone), Veneto (Fimon) and Liguria (Arene Candide) would suggest (ibid: 235; Pessina & Tiné 2008: 58).

The presence of approximately 100 burials in the area (the majority unearthed during excavations in the 19th and early 20th centuries but also in the last decade; Fig. 1.13), closely relating to settlements, have prompted speculations regarding the spiritual world of VBQ groups and the possible early emergence of a ranked society, anticipating an aspect which becomes openly marked during the Italian Copper Age (e.g. Barfield 1970; Bagolini 1980a: 139; Bagolini & Pedrotti 1998: 234; Bernabò Brea *et al*. 2006, 2007).
Chronologically, VBQ culture is subdivided into three broad phases, on the basis of pottery stylistic decoration (Bagolini *et al*. 1979):

- VBQ I, "geometric-linear style" (with earliest "formative" aspects in Liguria and EmiliaRomagna), (6200-5600 BP; Pessina & Tiné 2008: 58);
- VBQ II, "meander-curvilinear style" (5700-5300 BP; Ibid.);
- VBQ III, "incisions and impressions style" (5600-5100 BP; Ibid.).

These subdivisions also include minor sub-phases usually defined in terms of 'archaic' and 'fully developed' stages, which will be used throughout the present work since archaeological evidence is often referred to in this manner. It should be emphasised, however, that despite being convenient for archaeologists, the above-mentioned subdivisions do not necessarily reflect a real development in terms of adoption of different pottery styles. In fact, while the distribution of pottery belonging to the first phase appears spatially exclusive and chronologically well-defined, VBQII and III types are, at times, found to coexist or overlap both spatially and chronologically. This is well documented at the sites of Casatico di Marcaria (Biagi *et al*. 1983), La Vela (Pedrotti 1990b) and Gazzo Veronese, loc. Scolo Gelmina and loc. Ponte Nuovo (Salzani P. 2002a, 2002b, 2002c). In addition, the traditional scenario (Bagolini *et al*. 1979: 25; Biagi *et al*. 1983: 35; Biagi 1986: 286; Barfield & Bagolini 1991: 292) which viewed the gradual confinement of VBQIII settlements to the northeast (i.e., the Veneto, Trentino Alto Adige and Friuli Venezia Giulia) under pressure from western Chasséen influences, has recently been challenged in the light of new radiocarbon dates and published data from excavations carried out in the area (summarized by Visentini *et al.* 2004).

Although the available evidence is still problematic (Ibid.), a tentative overall presentation of VBQ development is attempted here with particular attention to the calibrated radiocarbon chronology (a complete list of C14 dates for sites mentioned in the text is to be found in Appendix One).

VBQ I

On the basis of the pottery typological evidence (i.e., there are no technological or archaeometric analysis of VBQ pottery; Mazzieri pers. comm. 2011), the only area where stylistic elements associated with the early VBQI phase are already present at the end of the early Neolithic is Liguria. In the Po Plain and in the Alpine area, it has been argued (e.g., Bagolini 1980a: 126; Pedrotti 2000: 126 but *contra* Mazzieri & Dal Santo in press) that the appearance of VBQI pottery marks a sharp break with previous traditions, despite the fact that many VBQI settlements appear directly 'on top' (stratigraphically) of early Neolithic sites. An opposing view is offered by the lithic evidence, since within the VBQI 'archaic' assemblages (such as those from Ponte Ghiara, Cantone di Magreta, Rivaltella and Quinzano), there survive several early Neolithic aspects (Pessina & Tiné 2008: 113).

VBQ II & III

As noted above, the scenario for phases II and III is rather complex. The two pottery styles coexist in a number of settlements and typical aspects of the VBQIII phase (i.e. the 'impressions & incisions' decoration) appear to be anticipated in VBQII contexts. Ferrari and colleagues (2002a: 103), using recently acquired radiocarbon dates (Pedrotti 1996; Visentini 2002) suggest the duration of the VBQIII style to be between 4500 and 4000 cal. BC, and VBQII between 4600 and 4200 cal. BC. However, perhaps because these two phases are still being defined, there is no unanimous agreement about their duration and an alternative date is given, for VBQIII, between 4540 and 4330 cal. BC (Visentini *et al*. 2004: 139). It is also important to note (see Appendix One) that many dates are calibrated at 1 sigma and others have wide standard deviations; therefore stylistic variation within the ceramic evidence has been used to construct a narrative for this period.

During the VBQII phase, evidence from settlements and burial grounds indicate contacts with central and southern Italy (i.e., Ripoli and Serra D'Alto pottery, Mottes 2001), the Balkans and the Aegean (Spondylus ornaments) and areas north of the Alps (*Schuleistenkeil* adzes) (Bagolini & Pedrotti 1998: 235). At this point in time, wider contacts seem to intensify and VBQ pottery with meander-curvilinear decoration is found at Lipari, in Apulia, Sardinia, the Balkans, South Germany, Switzerland, Austria, France and Spain (Ibid.: 236).

The 'encounter' between VBQ and neighbouring cultural groups (such as Chassey, Diana or Northern Alpine groups) produced a variety of localised responses which, as in the case of the site at Isolino di Varese, have been defined as cultures of their own. The group VBQ-Isolino, identified in a restricted area comprising northwestern Piedmont, western Lombardy, and southern Canton Ticino (southeast Switzerland), developed locally, according to Bagolini (1990-1991), from contacts between VBQI groups and north and northwestern alpine influences, gravitating around exchange networks which saw the circulation of flint, jadeite rocks, obsidian and northern Alpine ceramics especially in the north (e.g. Castel Grande di Bellinzona, Switzerland: Donati & Carazzetti 1987). Chronologically, this group is considered parallel to VBQII and VBQIII phases, with evidence for contacts in the Canton de la Valleé area (St. Léonard in SW Switzerland: Sauter 1963), at Isera la Torretta within an early VBQIII horizon (Pedrotti 1996), south of the Po River in Piedmont (Pessina & Tiné 2008: 56-57) and although indirectly, in Emilia Romagna, where VBQ-Isolino elements are found in the final stage of VBQII settlements (Ferrari *et al.* 2002a: 102). The VBQ-Isolino phase ceases completely, in radiocarbon chronology, with the start of the early phase of the Lagozza cultural group around 3900-3660 cal. BC.

In the area between western Friuli Venezia Giulia and southern Trentino Alto Adige, the first VBQIII pottery made its appearance around 4500 cal. BC (at Bannia-Palazzine di Sopra-Pordenone and Isera la Torretta-Trento, Pedrotti 1996) whilst in the Po Plain, groups characterised by meander-curvilinear ceramic types still flourished (Ferrari *et al.* 2002b: 370). On the basis of the available data and radiocarbon dates, in Trentino along the Adige Valley, the introduction and subsequent adoption of VBQIII elements appear to have taken place very rapidly (Bagolini & Biagi 1990), and in the case of La Vela (Trento) (Pedrotti 2001), coexisted within the same community, even though this might not necessarily mean that two distinct groups were living together as Ferrari and colleagues seem to imply (Ferrari *et al.* 2002a: 105).

Sites at which combinations of VBQII and VBQIII styles are present have also been identified in Lombardy at Grande Macchia Nera and Casatico di Marcaria (Biagi *et al.* 1983) and western Veneto at Gazzo Veronese, loc. Scolo Gelmina (Salzani P. 2002a, 2002b) and at Gazzo Veronese, loc. Ponte Nuovo (Salzani P. 2002c). At the same time, in southeastern Lombardy (i.e. Casatico di Marcaria), VBQIII elements are found together with an 'evolved' phase of VBQII. In the Verona and Trento areas (La Vela and Gazzo Veronese respectively), VBQIII elements were introduced at a very early stage of meander-curvilinear development. Some scholars (e.g. Ferrari *et al*. 2002a: 104) have suggested that this early introduction prevented VBQII in the Trento and Verona areas from reaching the stylistic elaboration typical of the 'fully developed' ceramics associated with this phase at settlements in Emilia or Piedmont, perhaps because of the peripheral character of the area.

Around 4300 cal. BC, in the northwest, Chasséen ceramics of western origins (from southern and eastern France), are found in Liguria (at Arene Candide: Bagolini & Biagi 1990; Maggi 1997) and in Piedmont (Alba, Castello di Annone and Valle di Susa: Gambari *et al*. 1992: 130-131). By the end of the 5th millennium BC, Chasséen material culture occurs as far as the western coast of Lake Garda and the Po plain (Ferrari *et al*. 2002a: 104). Parallel to the introduction of Chasséen material culture, influences from the cultures of Diana and late Ripoli penetrated into the Po Plain from the south along the Adriatic coast, and found their way into VBQII settlements (such as at Vecchiazzano: Massi Pasi & Prati 1988; Massi Pasi *et al*. 1996.). Such changes tend to be viewed either as local acculturation processes or as the result of the establishment of exchange networks between different communities (Ferrari & Mazzieri 1998).

The presence of both stylistic influences and material culture associated with Chasséen origins in the west, or Diana-late Ripoli provenance in southeastern Emilia-Romagna and northern alpine influences in the Veneto, Trentino Alto Adige and Friuli Venezia Giulia marks the transition from the middle Neolithic to the late Neolithic (i.e. 'Neolitico recente'). The distribution of VBQIII material appears to be concentrated in northeastern Italy, except for Piedmont, western Lombardy and Emilia, where only rare finds are recorded (e.g. at Castello D'Annone: Zamagni 1998; Pescale: Ferrari *et al*. 2002a; S. Andrea di Travo: Bernabò Brea *et al*. 1994). Radiocarbon dates from S. Andrea di Travo (Piacenza; Visentini *et al*. 2004: 140) and Rocca di Manerba (Brescia; Barfield & Buteux 2002) suggest the introduction of western Chasséen material culture in the Po Plain at a time when aspects of the VBQIII phase were already consolidated (Visentini *et al*. 2004: 140). For the time being, the prevailing hypothesis suggests that the VBQIII culture failed to reach beyond its northeastern area of origin, not because of the presence of Chassey groups, but because of the presence of VBQ-Isolino groups in the northwest, VBQII communities in the Po Plain and Diana/late Ripoli settlements in the southeast along the Adriatic coast (Ibid.).

The earliest evidence of interaction between western Chasséen and northern VBQIII is provided by ceramics unearthed at S. Andrea di Travo (Piacenza). From this moment onward, Chassey-Lagozza material culture gradually finds its way into northeastern Italy as far as the pre-Alpine Karst, marking a brief 'final Neolithic' transitional period, which leads to the Copper Age.

The term "Chassey-Lagozza" is often used to refer to the late Neolithic derived from western

Chassean influences. Bagolini (1990; Bagolini *et al.* 1998) defined the term on different occasions. Strictly speaking, "Lagozza" originates from the encounter of VBQ-Isolino groups with the Cortailloid (South Switzerland) and Chassean (eastern France), and spreading west from the area formerly occupied by VBQ-Isolino groups as far as Friuli Venezia Giulia towards the end of the Neolithic period. It characterizes the dawn of the Copper age in northern Italy. It is, however, not unusual to find cultural attributions such as "VBQIII with Lagozza aspects" or "Lagozza with VBQIII aspects", which in turn point to the contemporaneity of the two styles and the predominance of one style over the other or *vice versa*. In terms of radiocarbon chronology, the eponymous site of Lagozza di Besnate is dated between 3900 and 3100 cal. BC.

Copper artefacts are already present within late Neolithic contexts, starting from the mid-5th millennium BC, in association with VBQII and III and Chassean-Lagozzan pottery types (Pearce 2000, 2015; Ferrari et al. 2002a; Pessina & Tinè 2008). The earliest evidence of metallurgical practices in northern Italy is to be found at the site of Botteghino (Parma, Emilia Romagna) where a smelting slag and a crucible fragment were dated between 4505 and 4360 cal. BC (Mazzieri & Dal Santo 2007: 115). Such dating points to the presence of early metalworking in northwest Italy already in the middle to late Neolithic, well before the development of the Copper Age (for a discussion and list of finds see Pearce 2015: 48-51).

Although the present thesis is not the place to explore the relationship between metalworking and flint knapping, such topic would surely deserve further attention. In particular since the onset of metalworking seems to roughly coincide with changes in flint knapping techniques (and one would also assume at social level, including knapping organization, raw material procurement, knowledge transfer etc.) that have often been labelled as "poorer" in terms of technological and time investment or "expedient" in terms of skills needed to carry them out and the overall perceived value (for a discussion on the concept of expedient please see further pp. 39-42).

The world of VBQ lithics

One of the main reasons for undertaking the present work is the limited study of later prehistoric knapped lithics, and in particular VBQ flint artefacts in relation to the changing cultural patterns described above. The evidence available at present is mostly characterised by typological lists of tools (*sensu* Binford 1979: 269; Hayden *et al.* 1996): the debitage is generally taken into little consideration, and almost always only to identify the predominance of blades or flakes. On this type of data and on percentages of tool types are usually compared lithic assemblages coming from different sites. However, a few publications have asked more of the lithic findings; often combining a technological approach with use-wear analysis (e.g. Starnini & Voytek 1997; Conati Barbaro et al. 2002; Visentini 2005b; Dal Santo 2005; Mazzieri & Dal Santo 2007; Dal

Santo & Mazzieri 2010, 2014, in press). These works and available data from more traditional publications provide the basis for the following overview of northern Italian Neolithic knapped artefacts, focussing in particular on the VBQ period.

Early Neolithic flint assemblages in northern Italy are characterised, to varying degree, by the knapping of narrow blade and bladelet blanks for the production of tools such as long end-scrapers, geometrics (rhomboids and trapezes), retouched blades and bladelets, as well as sickle elements (Bagolini & Biagi 1977). A blade/bladelet reduction sequence stands out from the previous Castelnovian tradition, which saw the production of flakes and small flakes (Bagolini & Biagi 1988). With regard to the dimensions of formal tools, these are usually marked fromw previous microlithic and hypermicrolithic Mesolithic traditions, but not at all sites. At Suvero, an Impressed Ware settlement in western mainland Liguria, hypermicrolithic tools are still abundant, reflecting the preservation of original aspects of the Mesolithic tradition (ibid.). Typical tool types for this period are burins with a side notch, usually referred to as "Ripabianca burins" (Broglio & Lollini 1963) which appear for the first time in Adriatic Impressed Ware contexts, as well as at Fiorano and Vho settlements. Rhomboids and trapezes are also present in all cultural groups, although in different percentages, as is the microburin technique (Bagolini & Biagi 1988). Other tool types differ from group to group and are at times specific to one settlement. For example, sickle blades with sickle gloss have been found at Fiorano, Vho, Ligurian and Adriatic Impressed Ware sites but have not been recorded at Gaban (Trentino), nor at early Neolithic sites in Friuli Venezia Giulia. Overall, the early Neolithic is characterised by surviving Mesolithic elements (such as geometrics) which were gradually turned into specific and distinctive tool types (i.e. rhomboids and trapezes). These, together with a number of new tool types obtained from blades and bladelets, characterise the entire Neolithic period.

More detailed information comes from the cave site Arene Candide. Here, re-analysis of knapped lithics found in Impressed Ware contexts (Starnini & Voytek 1997) shows that elements characterising this culture are borers, truncations, trapezoidal and isoscele geometrics. A blade reduction sequence prevails, but sickle blades are rare, as well as the use of the microburin technique (ibid.). The Ligurian Impressed Ware lithic tradition points to a complete and drastic change from the Mesolithic tradition evident at Arene Candide (Biagi *et al.* 1993). Strong differences (in terms of both technology and typology) are also highlighted when comparing such assemblage to those from coeval sites in the Po Plain (Bagolini & Biagi 1975; Biagi 1987; Biagi & Voytek 1992; Starnini 1993; Starnini & Voytek 1997).

Regarding the circulation of raw material, it is with the development of the Fiorano culture that good quality Alpine flint begins to travel some considerable distance (e.g., Lugo di Romagna; Degasperi *et al.* 1998). The term "Alpine flint" refers to all lithotypes naturally occurring in an area including the Central Alps, the area to the north and east of Lake Garda as far as Monte

Grappa and the Euganei hills area (Cremaschi 1981; Ferrari & Mazzieri 1998; Ferrari *et al.* 1998; Barfield 1999). However, there are, a few Castelnovian sites in Emilia-Romagna (Biagi *et al.* 1980) and perhaps in Friuli Venezia Giulia (Candussio *et al.* 1989) where the presence of Alpine flint is recorded, leading to the supposition that circulation of Alpine flint occurred before the Neolithic. According to some authors (Pessina 1998; Ferrari & Mazzieri 1998) Fiorano groups in naturally rich flint areas of the Venetian pre-alps, would have played a major role in controlling both raw material procurement and its circulation. This argument has so far been supported by the predominance of Alpine flint at all Fiorano sites, where it is present in a variety of forms: from raw blocks at Ostiano-Dugali Alto (Biagi 1995) and Piancada-loc. Nogali (Pessina *et al.* 1998) to possible blade blanks at Fiorano Modenese, Lugo di Romagna and Sammardenchia, where the large cores and pre-cores suitable for the production of blades have also been recorded (Ferrari & Mazzieri 1998). Workshops that specialised in the production of blades are also documented at Piancada (Pessina *et al.* 1998) and at Lugo di Grezzana, in the foothills of the Lessini Mountains (Moser & Pedrotti 1996). The latter has been interpreted as a workshop site specialising in the production of blade and bladelet blanks: from here such artefacts would have travelled to Po Plain sites as blanks ready to be retouched into specific tools (ibid.). Evidence of long-distance contacts is also supported by the presence of obsidian (from Sardinia and the Pontine islands, Ammerman & Polglase 1993, 1998) at the cave site of Arene Candide.

Contrary to the VBQ pottery evidence (see above), which seems to mark a clean break with previous early Neolithic traditions, 'archaic" VBQ I lithic assemblages (such as those from Ponte Ghiara, Cantone di Magreta and Rivaltella) maintained several aspects of the early Neolithic, such as the use of the microburin technique and the presence of a number of tooltypes (rhomboids, piercers and scrapers on blades) (Bagolini & Biagi 1988; Pessina & Tiné 2008: 113). At the same time, the typical flat retouch technique made its appearance during the fully developed VBQ I phase at sites such as Quinzano (Biagi 1972), Fimon (Barfield & Broglio 1986), Benefizio and Via Guido Rossi, though there is no trace of it at Ponte Ghiara (Dal Santo & Mazzieri 2014).

Throughout the entire development of the VBQ, knapped lithic artefacts seem to reflect the same overall homogeneity showed by the pottery (ibid). The main trait is the production of blades and bladelets by means of indirect percussion: this is documented at a very early stage of VBQI phase (e.g., at Ponte Ghiara: Dal Santo & Mazzieri 2010), during the fully developed VBQI stage (e.g. Benefizio: Dal Santo & Mazzieri 2014; Fimon-Molino Casarotto: Gardin 2008), at sites characterised by VBQII pottery assemblages (Via Guidorossi-Parma: Dal Santo & Mazzieri 2014), and, although less distinctively, during the latest phase of 'incisions and impressions' (e.g. at Bannia-Palazzine di Sopra: Visentini 2005b; Dal Santo & Ferrari 2005).

From a typological view Bagolini (1980a: 131) noticed that lithic assemblages from sites belonging to the first phase of the VBQ culture present a high incidence of flatly retouched artefacts (in particular tanged arrowheads), and long side- and end-scrapers. More recently, thanks to the discovery of new sites (especially in Emilia-Romagna) where the evidence points to a transitional period between Fiorano groups and earliest VBQ, the initial picture drawn by Bagolini has been greatly enriched in terms of data regarding not only the typology but also the technology of VBQ lithics (Dal Santo 2003, 2005).

Remaining tool types, with some variation, common to all sites belonging to the different VBQ cultural phases are:

1. End scrapers on blades (most with the front on the distal end).
2. Sickle blades with gloss along or parallel to the retouched margin (Biagi & Nisbet 1987).
3. Retouched blades.
4. Truncations *à piquant triédre*.
5. Geometrics (asymmetrical trapezes, rectangles).
6. Burins.
7. *Piéce escaillée*, although these seem to mostly characterise sites where the processing of steatite takes place.

In addition, a typical aspect of the VBQ lithic tradition is the use of the flat retouch technique, mainly employed in the production of points and arrowheads, but also side- and end-scrapers. Little information is available concerning VBQ cores. These are generally described in terms of their shape (pyramidal, poliedric etc.) which indicates little about procurement and knapping strategies (e.g., Bagolini in Barfield & Bagolini 1976: 75-111). More detailed data comes from recently published lithic assemblages from Ponte Ghiara (Dal Santo & Mazzieri 2010) Benefizio (Dal Santo & Mazzieri 2014) and Bannia-Palazzine di Sopra (Dal Santo 2005; Visentini 2005b), where a more openly technological approach has identified the probable presence of apprentices and suggested a whole series of new avenues to explore in terms of knowledge transfer and creation of a 'craft' tradition (Dal Santo & Mazzieri 2010).

Related to VBQ repertoires, but set apart from them, are the lithics from VBQ-Isolino sites, initially described by Bagolini (Bagolini 1980a: 112). VBQ-Isolino assemblages are mostly characterised by tools with abrupt retouch, which according to Bagolini developed directly from a local Mesolithic tradition. Such a retouch technique appears to survive for the entire duration of VBQ-Isolino culture at the expense of the flat retouch technique. The latter remains extremely rare, contrary to what happens in VBQII and III phases outside the VBQ-Isolino area. Bagolini (ibid.) viewed VBQ-Isolino lithic assemblages as a continuum of techniques and traditions throughout the Neolithic period, with certain aspects surviving into the following Lagozza culture.

During the VBQII phase, in addition to what has been already described above, there was an increase in the presence and variety of flatly retouched tools, especially leaf-shaped points (Bagolini 1980a). These types continue to be present throughout the VBQIII phase and, together with small flat-retouched points, arrowheads (e.g. barbed-and-tanged, one-face or bifacially flat-retouched), summarily retouched tools and proto-Campignan tools, characterize this phase (Pessina & Tiné 1998: 113). In addition, it is worth pointing out that, apart from typological change, a technological change took place which saw a gradual shift from the use of blade blanks to that of flake blanks, starting from the VBQII phase (ibid.).

Parallel to this technological shift, there appears to be a change in raw material procurement strategy in Emilia-Romagna. Alpine flint was replaced by more closely available (i.e., Apennine) and local flint types (Dal Santo & Mazzieri 2014). In addition, the influence of Chassey material culture, gradually spreading from the west (southern France) was signalled by the appearance of distinctive tool types traditionally associated with the earliest stages of this culture, such as kite-shaped arrowheads and bifacial points, flatly retouched trapezes with long tangs, steeply retouched tools, backed blades and bladelets.

Regarding VBQIII lithic production, a review of the published data from five sites (Bannia-Palazzine di Sopra, Casatico di Marcaria, Rocca di Rivoli, Monte Covolo and Palù di Livenza: Visentini 2005b) has shown that within VBQIII assemblages (apart from Rocca di Rivoli) flakes and large flakes prevail (30% and 20-30% respectively) whereas large blades or blade-like-flakes (10-20%) and blades (only 5-10%) are less common. Despite the differences among these assemblages, from a typological point, flatly retouched tools and end-scrapers are the most abundant tool-types, followed by abruptly retouched tools. In the areas where VBQIII settlements continued to thrive, despite influences from Chasseén and Adriatic groups, most flint was of Alpine provenance, such as at Bannia-Palazzine di Sopra, where 90% of the entire tool-kit comes from the Venetian pre-Alps (Cottini *et al.* 1996; Dal Santo & Ferrari 2005: 98; Visentini 2005a: 181).

Circulation of Alpine flint outside VBQ territory during the VBQIII period is documented by finds at Spilamberto III, Rocca di Manerba and Monte Covolo (Ferrari *et al.* 2002a). In addition, despite the fact that macroscopic observation of the cortex can only tell us which general type of outcrop the flint nodule might have come from, Visentini (2005b) pointed out that flint variability in terms of colour, texture and provenance increases during VBQIII, contrary to the overall homogeneous character of Alpine flint reaching Fiorano sites such as Valler and Fagnigola (Dal Santo & Ferrari 2005).

A similar role to that of Lugo di Grezzana for the early Neolithic has been attributed to Rocca di Rivoli during VBQII and III (Barfield & Bagolini 1976; Barfield 1999, 2000; Barfield & Buteux 1999: 16-18; Mottes 2002), and more generally, to VBQ groups settled within areas naturally rich in flint outcrops.

Italian Alpine flint has been recorded in Switzerland, on the south of Lake Neuchatel, in the Valais area (Affolter 1999, 2002) and in the area around Lake Constance in Pfyn-Altheim contexts (Königer & Schlichterle 2001), in Tyrol, and on the Karst mountain range (Bagolini & Pedrotti 1998). However, such attributions need to be considered with some caution, as they are primarily based on macroscopic identification. The latter is the main methodology in use and for the time being it cannot be considered 100% certain. This methodological limit undoubtedly affects the elaboration of flint circulation models and inferred exchange relations, and has also resulted in problematic attributions (e.g. Chelidonio 1999). Despite repeated efforts to tackle the issue (e.g. Candelato *et al.* 2003), results have been rather unsatisfactory, and for the time being the creation of a "*lithotheque*" with samples collected from extant primary and secondary deposits remains perhaps the most methodologically sound approach (Inizan *et al.* 1999).

The role of lithics in Italian late prehistoric studies

With the beginning of the Neolithic, increasingly richer evidence of past human life survives in the archaeological record, with the consequence that lithic artefacts, so instrumental for the understanding of the Palaeolithic and Mesolithic periods, are often largely disregarded in favour of pottery finds. The latter have been held to better reflect stylistic variability, which in turns plays a major role in defining ancient culture and identity, technology and function, aesthetics and symbolism.

As Chapter 2, dealing with theoretical approaches, will demonstrate, lithic studies since at least the early 1970s have engaged in a wider conceptual and methodological framework. At its centre lies issues of cultural identity, technological development and social organisation. Such developments have been considered by Italian Palaeolithic lithic specialists, but have only recently started to break through the established typological tradition which characterises research in later prehistory. In general, Italian prehistorians have been slow to adopt explanatory models and new methodologies, and instead have favoured the traditional typological approach. This has translated into the isolation of Italian later prehistoric studies, especially lithic studies, from neighbouring areas of Europe (France in particular).

There are some historical reasons that can account for this slow development. According to Tarantini (2005, 2008) Italy suffered a considerable delay in the development of a research framework for the study of the Palaeolithic. The cause of this delay was primarily due to the so called *"egemonia pigoriniana"*; the supremacy of Luigi Pigorini, who between1880s and 1910s dictated both research agenda and methods in Italian prehistoric archaeology. Apart from denying (among other things) the existence of an Upper Palaeolithic in Italy, Pigorini established the basis for a purely humanistic approach to the study of prehistory (Tarantini 2008).

It was only with the death of Pigorini that a group of scholars urged the integration of the humanistic approach with theories and methods coming from the natural sciences. However, this meant the introduction of typological classification at the expense of technological analysis and experimental replication. Such a dominant position for a naturalistic approach has been associated with the presence of George Laplace in Italy in the aftermath of a major split in the Italian scientific community. On one side there was Paolo Graziosi, arguing for a humanistic approach. On the other was Alberto Carlo Blanc, who pushed for the adoption of natural sciences research methods (Tarantini 2005). At this time, George Laplace was working at his newly defined "*typologie analytique*", which came to fill a methodological void in the study of Upper Palaeolithic assemblages. With the introduction of the so-called "Laplace method", widely acclaimed by both humanistic and naturalistic 'schools', typological seriation was applied to all periods by means of matching, almost one by one, later lithic types with Laplace's Upper Palaeolithic tool-types.

Prior to the adoption of Laplace's method, it was not unusual to find papers in which lithic analysis included aspects of technological behaviour, such as raw material description, *débitage* analysis, examination of flake and blade morphology (e.g., Broglio 1961; Palma di Cesnola 1962). However, from the 1960s until very recently, lithic analysis for Italian prehistorians has been equated almost exclusively with typological description and tool type quantification as a means to assess intra- and inter-assemblage variability and to identify activity areas in order to define site types. The study of knapped lithic assemblages thus concentrated on *a priori* selection of retouched artefacts and formal tools, whereas the debitage was very rarely taken into consideration. It is, at times, difficult to tell whether selection took place on site or during post-excavation analysis, since explicit reference to excavation methodologies and quantification of artefacts are often missing. Thanks to the work of Bernardo Bagolini (1968), unretouched blades and flakes were finally given some of the attention they deserved by means of plotting the length/width ratio of each complete artefact on a scatter diagram. In this way, it was immediately visible whether the assemblage was characterised by small or large flakes, blades or bladelets. The "typometric method", as Bagolini (ibid.) named it, has been subsequently used by most scholars and has greatly contributed to the identification of tool blanks and, in very approximate terms, core reduction strategies.

The fixation with typology has dominated Italian later prehistory lithic studies for over 50 years. Typology meant that archaeological investigation was aimed at answering a very narrow range of research questions. Often authors chose to ask only one question: what type of tools did people produce? On the basis of tool type ratios, chronological marker tools were identified and comparisons between coeval sites were drawn. At intra-site level, activity areas were determined on the basis of tool-type concentrations, whereas at the inter-site level, the same concentrations represented different site types. Technology, if considered at all, was only skimmed on the surface (for example, with regard to different types of raw material within the same assemblage). Typology, therefore, became the only approach which seemed to make sense of the flaked tools, and all that seemed important was to identify tool types, chronological and cultural markers, and correspondences between the two.

Despite several attempts, to go beyond typology in order to explore the relationship between lithic sources and human settlements (Barfield 1987; 1990), or between tool shape and function by means of microscopic analysis (Bagolini & Scanavini 1974), the traditional role of typology in Italian lithic studies was challenged only by the introduction of use-wear analysis. In fact, despite the appearance of analyses of use-wear traces on prehistoric artefacts in publications from the mid-1990s (e.g. Longo 1994; Longo *et al*. 1997; Starnini & Voytek 1997), it is only with Longo and colleagues (Longo *et al*. 2000-2001) that the methodological basis is discussed with specific reference to Italian lithic studies. It was also at this point that the need to adopt the *chaîne opératoire* method, together with use-wear analysis aided by replication experiments, was urged upon the Italian scientific community. It is small coincidence that works adopting (to varying degrees) a technological approach date back only to the period after 2000 (e.g. Conati Barbaro *et al*. 2002; Dal Santo 2003, 2005).

Research aims

The lithic material recovered from the Neolithic levels at Rocca di Rivoli during the 1963-68 excavations were studied by Bernardo Bagolini (Barfield & Bagolini 1976). Bagolini undertook the typometric analysis of approximately 6,000 artefacts, part of which were also classified typologically (ibid.: 75-126) according to Laplace's seriation criteria (Laplace 1964). Published results suggest an assemblage dominated by small artefacts, with a tendency to microlithisation, with burins and scrapers as the most common tool-types, followed by a range of flatly retouched points (leaf-shaped arrowheads and points, lozenges and ogives) (Barfield & Bagolini 1976: 121). Bagolini also pointed out the presence of different varieties of flint types and implicitly suggested the existence of patterns in relation to the fills of the pits. The work undertaken by Bagolini (Barfield & Bagolini 1976) was, and still is, extremely important for the Neolithic of northern Italy. The publication of the lithic finds from Rivoli provided one of the most comprehensive descriptions of a middle to late Neolithic (and Bronze Age) flint tool assemblage, which still represents a point of reference in terms of methodology and tool types.

However, in light of more recent developments in the field of lithic studies as well as in relation to research concerns in northern Italian prehistory, a number of key issues still remain to be addressed, especially with regard to the following:

1) Raw material procurement. The main questions which I am attempting to answer with the present work are: which types of raw material did the flintknappers use? Where did they obtain their raw material? How was raw material procurement organized?

2) Production and use. I am mostly interested in technological practice, especially the organization of flintknapping. How did this take place at Rocca di Rivoli? Is it possible to recognise different *chaînes opératoires*? What do they tell us about group dynamics, knowledge sharing, the existence of a tradition, or the presence of apprentices?

3) Discard behaviour. Excavations at Rocca di Rivoli produced a huge quantity of flint finds. These were recovered, mostly, in pits dug at the site at different times. Is it possible to recognise any patterns in the behaviour leading to lithic discard at the site?

The main aim of the present work is to shift the focus from the artefacts to the knapper, from a typological approach that merely describes the finds, to a wider focus on the relationship between the knapper and the manipulation of flint from blocks of raw material to the final discard of knapped artefacts. I set out to answer the questions briefly outlined above through two innovative approaches to Italian prehistoric lithic studies. The first is the adoption of an explicit social anthropological theoretical approach applying the *chaîne opératoire* research method at both theoretical and analytical levels. The second is the creation of a database centred around technological attributes rather than pre-determined tool-type categories.

Although no use-wear analysis has been undertaken for the present work, it is possible to identify the products of apprentices and of skilled knappers, but also, in some instances, to show how tools were finalised and subsequently rejuvenated or modified to be used further. Knowledge transfer, specialization, curation, the creation and maintenance of a so-called ‘tradition’, symbolism and aesthetics are all avenues rarely found in the literature pertaining to Italian lithic studies, and when present, are tentatively suggested more as a general ‘feeling’ rather that on the basis of quantifiable data. At the same time, the definition of these terms is also rather blurred: their value will be discussed in relation to the late Neolithic and with reference to Rocca di Rivoli material in particular.

Thesis organization

In these last paragraphs I briefly introduce the chapters which will follow, in order to present the overall organization of the present work.

Chapter 2 will provide a brief overview of theoretical developments in the field of lithic studies and related disciplines, such as prehistoric technology, social agency, material culture studies and anthropology. These have significantly contributed to the creation of a framework through which the relationship between human beings and their material culture in the past can be explored. The main aim of this chapter is to make it clear to the reader which works and debates have influenced the approach embraced throughout this thesis, and therefore the methodology adopted, as well as the analysis as far as the presentation of the results and inferred reasoning are concerned.

Chapter 3 presents the archaeology of Rocca di Rivoli and the results of the excavations undertaken there between 1963 and 1968. Critical aspects and the nature of the available data will be discussed and how these might affect following analysis.

Chapter 4 is dedicated to the methodology adopted in collecting and managing the data necessary to undertake the study presented here, and in particular the rationale behind the creation of the database.
Chapter 5 is dedicated entirely to the raw material: from the criteria employed in the identification of primary and secondary outcrops, to the problematic process of identifying an artefact lithotype.

Chapter 6 introduces the lithic sample analysed for the present work in order to provide a general idea on the nature of the assemblage, mainly in terms of quantification.

Chapter 7 explores the first stage of the *chaîne opératoire* through the analysis of raw material procurement at Rocca di Rivoli. Knappers' choices of flint types and organization of procurement at community level are discussed.

Chapter 8 moves on to the following *chaîne opératoire* stages of cores preparation, reduction and *remise-en-forme.* Analysis concentrates on recorded attributes for cores and debitage, exploring patterns in the data to gain an understanding of flint knapping as social practice.

Chapter 9 analyses the transition from the selection of blanks to be further shaped through retouching to the final discard of the artefacts. Retouch is explored as a technological practice with a focus on the ways artefacts were modified, rather than as a means to attribute artefact function. Finally, attitudes to disposal are explored in relation to pit digging and filling at Rocca di Rivoli.

Chapter 10 draws the conclusions of the present work by discussing the results in the wider context of the northern Italian Neolithic and lithic studies in general.

Chapter 2

THEORETICAL APPROACHES TO THE STUDY OF LITHICS

Introduction

As briefly pointed out in chapter one the study of later prehistoric lithic artefacts has seen a gradual but decisive shift from typology to technology over the past 30 years. This shift is strongly characterised by a social anthropological approach to the study of material culture, in which the production, use and discard of artefacts are seen as meaningful acts of social engagement with the material world (Hodder 1982a, Lemonnier 1986, Dobres 2000: 96). In this view, technology is held to be a medium through which world views, values and symbolism are expressed and reaffirmed over and over again: technological processes give life not only to tangible artefacts but also personal, practical and cultural knowledge that plays a crucial role in defining, transforming and reaffirming social practices (Dobres 2000: 96-112, Lemonnier 1986, 1990).

As a result, the study of lithic artefacts has become less geared around typological classification of formal tools *per se* and more concerned, for example, with answering research questions relating to the procurement of raw material in order to gain insights about social organization and resource control, or the *modus operandi* of past knappers in order to investigate the existence of traditions and how knowledge was shared. Attention has decisively shifted from artefacts to people, at both theoretical and methodological levels, with lithic specialists striving to shed light on past technological processes as a means to understand the ancient mind and its 'being in the world' (e.g. Renfrew & Zubrow 1994; Dobres 2000, Léa 2005).

In the previous chapter it was pointed out that Italian lithic specialists dealing with evidence from later prehistoric periods have struggled, in general, to be part of this major shift, and have fin most cases, been reluctant to break through the limits of Laplace's analytical typology (Laplace 1964). This trend has largely prevented any engagement with wider conceptual and methodological frameworks, at the centre of which lie issues of cultural identity, technological development and social organisation. There are, however, a few notable exceptions (e.g. Conati Barbaro 2002; Dal Santo & Mazzieri 2010) that witness the great potential of a socio-anthropological approach also for Italian Neolithic studies.

This chapter will firstly review current theoretical approaches to technology, outlining how the use of agency theory can be employed to investigate the complex relationships between prehistoric people and their technologies. It will subsequently evaluate the *chaîne opératoire* concept as a theoretical approach and an analytical tool which has been successfully applied to the study of lithic evidence. Key themes and approaches in lithic studies, focusing on procurement, production, use and discard, will also be reviewed. An overview of the current state of research and approaches adopted by regional studies in Italian Neolithic lithic assemblages will also be provided. Finally, the theoretical stance embraced by the present study will be outlined.

Current approaches to technology

Archaeology and anthropology have always been concerned with the study of technology, which has played a fundamental role in elaborating models of human evolution and civilisation. The production and use of tools, traditionally viewed as the immediate, still tangible, outcome of past technological processes, have been held to separate human beings from all other animal species (Wissler 1923). Since the very early days of archaeology as a systematic and scholarly discipline, evolutionary theories were built on the basis of how tool forms and techniques of production change through time and across space, in a linear and progressive manner (e.g. Pitt-Rivers 1875; Tylor 1878). At the same time, the concept of technology and its underlying assumptions have rarely been studied in archaeology (Dobres 2000: 11; Gero 1991; Graves-Brown 1995a, 1995b; Ingold 1990, 2000; Pfaffenberger 1988, 1992; but see Cresswell 1972; Balfet 1975).

The term ‘technology’ is a recent western invention: it appeared for the first time towards the end of the 18th century, defined by the German philosopher Christian Wolff as “the science of the arts and of the works of art” (quoted in Mitcham 1994: 31). Fifty years later, Jacob Bigelow’s “Elements of Technology” (1831) defined technology as “the principles, processes, and nomenclatures of the more conspicuous arts, particularly those which involve the application of science” (quoted in Mitcham 1994: 31). The explicit focus on functional and material aspects that characterise the term today developed between the end of the 18th century and the beginning of the 19th century, during which a decidedly modern view was established that made technology “a distinctive sphere of materially grounded pragmatic behaviours separate from, underlying and impinging upon politics, social organisation, beliefs and value systems” (Dobres 2000: 10). This view is also expressed by Pfaffenberger (1988: 237) who, after reviewing numerous definitions of technology, pointed out how the term has largely to do with “the sum total of man’s ‘rational’ and ‘efficacious’ ways of enhancing ‘control over nature’”. This accords with Schon’s (1967:xx) view that technology is “any tool or technique, any physical equipment or method of doing or making, by which human capability is extended”; and with Spier’s definition (1970: 2) of technology as the means by which “man seeks to modify or control his natural environment”.

Pfaffenberger identifies a ‘standard view’ of technology, which has developed to accommodate two predominant perspectives on the relationship between technology and human behaviour:

“technological somnambulism” which sees technology as a straightforward, neutral occurrence between human beings and their material world, and “technological determinism” which holds technology self-generating from laws that govern the physical and biological world, unilaterally affecting human beings (Pfaffenberger 1988: 238-239, 1992). Parallel to, and contrasting with these two predominant views, however, lies the technological approach of the French social-anthropological tradition, which predicates a radical social approach, the genesis of which is to be attributed to Marcel Mauss’ *oeuvre* (e.g. 1936, 1947), further discussed and developed by A. Leroi-Gourhan (e.g. 1960), A.-G. Haudricourt (e.g. 1964) and R. Cresswell (e.g. 1972, 1983, 1996).

The standard view of technology

The concept of technological somnambulism (first defined by Winner in 1986:10) views the relationship between technology and human behaviour in terms of “production” and “use”: an unconscious, habitual process enacted by non-reflective human beings (Pfaffenberger 1988, 1992). Technological determinism, is the view that technological discoveries and applications take place according to their own inner necessity, affecting passive human beings who are merely passive respondents to external stimuli (Drygulski Wright 198:9; Pfaffenberger 1988:239; Dobres 2000: 33-35; Loney 2000). Although distinct, both notions have their origin in western concepts of technology, and both underlie much of the thinking, until very recently, about prehistoric and/or non-western technologies. In addition, both have three recurring assumptions in common which have been criticised by archaeologists and anthropologists advocating the social dimension as the explicit focus of research into technology (e.g. Dobres 2000; Dobres & Hoffman 1994, 1999a; Edmonds 1995; Greene 2004; Ingold 2000: 289-419; Loney 2000).

The first assumption is that “necessity is the mother of invention” (Pfaffenberger 1992: 495). In this view, nature defines necessity and culture is a nature-driven technological evolution (ibid.). As a result, like any natural phenomenon, it is assumed that technology can be objectively studied and remains a valid and reliable tool for understanding cultural change. In processual archaeology, technology was viewed as a subsystem of culture, the latter defined as the “extrasomatic means of adaptation for the human organism” (Binford 1962: 217). Material culture, the tangible form of technology, represents the means by which humans have adapted themselves to environmental conditions and risks (e.g. Binford 1965, 1979; Torrence 1989a). In doing so, human beings in the past have been held to act rationally, guided by general principles of formalist economic and optimal foraging theories, according to universal least-effort principles of optimization (Halperin 1994: 22-23). Despite numerous critiques of processual archaeology, archaeologists still tend to project their own cultural values and their own post-industrial perception of technology onto past societies. This is immediately noticeable in narratives where technology, and in particular lithic technology, is portrayed as an adaptive effort, nearly always pertaining to the male domain (Brumfiel 1992; Dobres 2000: 14-16, 19-33; Gero 1991; Pfaffenberger 1992).

The second assumption is a by-product of the first. An artefact is often considered as having two distinct meanings: a primary, functional one, and a secondary, stylistic or social/symbolic one. As a result, human behaviour has mostly been explained in functional terms, often equated with economic behaviour separately from social relationships and society (Dobres 2000: 37; Edmonds 1990, 1995: 9-19; Lemonnier 1993). Although social aspects have been introduced and (up to a certain extent) taken into consideration, the attempt to understand the relationship between technology and society is usually limited to the study of how technological systems condition culture and society. In so doing, this relationship is reduced to matters of communication and style, or considered as secondary to technical/physical constraints (Conkey 1990). In general the role of techniques as embedded in social construction has mostly been overlooked, resulting in an explicit focus on tools rather than on tool-makers (Ingold 2000: 346; point made also by Dobres 1995: ch. 1 & 2).

The third assumption is that the evolution of technology is a one-way process: from simple tools to complex machines, linked to the ever progressive shift from simple to complex social organisation (Dobres 2000: 17; Pfaffenberger 1992). Material culture in this view becomes the sole trait by which to measure and assess the evolving complexity of technology, according to criteria set on the basis of our western capitalistic world view. Without going into too much detail here (but see Dobres 2000, chapters 3 & 4, esp. 39-40), it is often implicitly held that technology is able to exist before the adequate social organization can develop (Hayden 1995, 1998; Testart 1982; but see Bender 1985a, 1985b; Ingold 1988), which is to say that each particular 'product' has its own material and technical requirements, and these in turn need their adequate 'organization of labour', which is guaranteed by an adequate form of social control.

A number of anthropologists and archaeologists (e.g. Dobres 2000; Gero 1991; Ingold 1990; 2000; Pfaffenberger 1988, 1992; Reynolds 1993) have denounced how the shift from the classical concept of *techne* + *logos* to the modern concept of technology has privileged the study of the technological process and its final product from a 'logic', and as much as possible 'objective' viewpoint. By separating practice (*techne*) from knowledge (*logos*), the all-encompassing significance of technology - which might be defined (after Dobres 2000: 50) as "the instantiation through practice and application of an inseparable combination of art, skill and craft, principles of knowledge, methods, understanding and awareness" - has been lost. With regards to prehistoric technology, this attitude has translated into the isolation of the tangible artefact from the intangible actors and practices that played a fundamental role in the artefact's creation and use: a phenomenon which has been counteracted by a social approach to technology.

French anthropology and agency theory: back to a social approach

A profoundly different approach to the study of technology characterises the French anthropological and ethnological tradition. In 1947 Mauss conceived technology as a 'total social fact' and introduced the notion of '*systeme technique'*. According to him every technical action is necessarily embedded within social practice: "the invention of movement and of the tool, the tradition of its usage, usage itself, and the practical arts are essentially social" (quoted in Schlanger 1998: 198). A fundamental interaction and interdependence is in place between techniques and social relations, and the study of the nature of such relationships is perceived by some anthropologists as an "urgent matter" (e.g. Lemonnier 1983).

In place of the mystical and individualistic notion of *Homo faber* (or *Homo technologicus*, after Dobres 2000: 41-43) engaged in instinctively creative actions driven by the idea that "necessity is the mother of invention" (Pfaffenberger 1992: 495), the human being is conceptualised as '*homme total*', that is 'the total human *being*' (translation by Schlanger 1998: 199; my emphasis). In Mauss', and similarly in studies making use of agency theory (e.g. Dobres 2000; Dobres & Robb 2000; Gosden 1994: 86), the emphasis is placed on the condition of 'be-ing' in the world, both material and social, as an active 'agent', i.e. a mindful and knowledgeable individual belonging to a group of individuals who express their involvement in the world by partaking in technological practices and by so doing actively shape (through negotiation, confrontation, conformation to etc.) the world around them. Because techniques are learned, acquired and transmitted, Mauss (1936; in Schlanger 1998: 198) describes them as 'traditional'. Learning a technique takes place in a collective context, which forms and informs the social constitution of its actors: "Each traditional practice which has a form, and which is transmitted by this form, is to a certain degree symbolic. When a generation transmits to the next the science of its gestures and of its manual acts, there is as much authority and social tradition in this transmission as there is in linguistic transmission" (Mauss 1936; in Schlanger 1998: 199).

Technical gestures with the skills, knowledge and symbolism which technicians put in them, take place in the context of traditions, normative values, and expectations about how things should be. They give life and meaning to what Bourdieu (1977: 106) termed *habitus*: "a system of lasting transposable dispositions which, integrating past experiences, functions at every moment as a *matrix of perceptions, appreciations, and actions* and makes possible the achievement of infinitely diversified tasks". *Habitus*, it is argued, underlies collective technological practice and plays a fundamental role in materializing and reaffirming social representations of the world (Lemonnier 1986; Gosselain 1998). *Habitus* acts as the "unconscious harmonization of social life" (Gosden 1994: 119) and provides agents with "trust in the fabric of social activities and the object world that comprises the course and circumstances of their daily lives" (Cohen 1987: 302).

Artefact production is a social act in which: "Man creates and at the same time he creates himself; he creates at once a means of livelihood, purely human things and his thoughts inscribed in these things" (Mauss 1927: 197). Subsequently, our understanding of the meaning of the term ‘artefact’ cannot, any longer, refer only to a physical object but needs to include rites, ceremonies, activities and gestures (Dobres 1995, 1999, 2000; Dobres & Hoffman 1994, 1999a; Hoffman 1999; Ingold 1999; Pfaffenberger 1999; Schiffer & Miller 1999).

Furthermore, it is argued that all activities are constructed in, and themselves construct, human interactions and are therefore always socially meaningful. Thus, technology should no longer be seen as an external and objective aspect that influences, but is not influenced, by people. Instead it is “a dialectic of cultural practices, beliefs, social relations, politics and mental realities” (Dobres & Hoffman 1999b: 3). To repeat Mauss’ synthetic definition, technology is a ‘total social fact’. Under the premises of this totality, the artefact itself becomes a document that informs at many levels, that can be itself the evidence for the social fact (Schlanger 1998: 200).

Agency theory for its part has brought the focus onto people as skilled and knowledgeable individuals, highlighting the reciprocal nature of the relationships between microscale events (taking place at a personal/individual level) and macroscale processes (taking place at a communal group/society level) (Dobres 1999; Pfaffenberger 1999). Daily-life, routine events and actions are intimately linked to interactions between individuals and groups, they shape tradition allowing for personal and communal behaviours reflecting different attitudes and interests. These in turn are reflected in tangible and intangible acts and objects (Dobres 1999, 2000; Dobres & Hoffman 1994, 1999; drawing on Bordieu’s theory of practice 1977).

The emphasis on cultural rather than on environmental determinants necessarily requires a re-evaluation of the traditional boundary between practical behaviour (economic, functional, domestic) and socio-political, ritual and ideational behaviour. For some authors (Cresswell 1990; Dobres 1995, 2000; Graves-Brown 1995b; Hodder 1990; Ingold 1990; Lemonnier 1990, 1993; Robb 1998) such boundaries appear so arbitrary that they should be dispensed with entirely. In conclusion, social approaches to technology redefine technology as a “verb of human action and interaction” (Dobres 2000: 83), as a meaningful act of social engagement with the material world which offers the opportunity to express, negotiate and define ideas, principles and beliefs. Because of the inseparable relationship between meaning and the material world, brought together through technology as social practice in a way that the production of matter and the production of meaning are represented by each other, archaeologists are in a position to understand the intangible but meaningful prehistoric world through the study of the tangible remains (Hodder 1982a, 1982b, 1986; Lemonnier 1990).

The question which arises at this point, is how such understanding can be achieved. How can archaeologists identify social agency in the archaeological record? How can they make sense of the multifaceted dialectic between agents (individuals and collectivities, social relations, institutions etc.) and the perceived/experienced structures (conditions, rules, resources, overall contexts, habitus) which agents reify during technological practice in everyday life? If the unearthed archaeological remains are not the reflection of past processes, these constitute the material data archaeologists set out to analyse and from which to infer past dynamics. There are compelling examples of technological studies that go in this direction (e.g. Bodu *et al.* 1990; Dobres 1995), and instrumental to their successfully bringing to light the social dimension is the adoption of the *chaîne opératoire* research method.

The chaîne opératoire: a theoretical and methodological framework

The *chaîne opératoire*, (literally "operational chain" or "sequence") is summarised by Perlès (1987: 23) as "the succession of mental operations and technical gestures, [used/necessary] in order to satisfy a need (immediate or not), according to a pre-existing project". This idea, made explicit in the works of Leroi-Gourhan (1964: 164, 1993), was already implicit in Mauss' studies of the sequential nature of bodily actions and attitudes experienced as one goes about technical tasks (e.g. Mauss 1936). The *chaîne opératoire* concept has quickly come to be referred to as both an analytical method and a conceptual framework, which aim to account for human choices and social dynamics through the identification of the sequence of technical operations within which the artefact takes shape and is further manipulated.

In its early definitions as a conceptual framework, the focus of the *chaîne opératoire* was on the alterations to the material expression of socially embedded repeated gestures, such as hand and body movements used in the manipulation of material objects (Soressi & Geneste 2011). This emphasis on the social dimension has been shared by a number of definitions, such as Chazan's (1997: 723) who holds the *chaîne opératoire* to be "the unfolding of a technical act" and Lemonnier's (1992: 26) idea of a "series of operations involved in any transformation of matter (including our own body) by human beings".

As a tool for lithic analysis, the *chaîne opératoire* approach "takes into consideration all the processes, from raw material procurement to final discard/abandonment, through all stages of production and utilisation of an artefact" (Inizan *et al.* 1999: 14). Through the identification of specific elements (technological attributes, use-wear traces or specific chemical make ups) it is possible to infer, with varying degrees of confidence, a number of technical actions and the sequential reconstruction of the technical process through which raw materials are transformed into cultural artefacts. As such, it may be compared to other sequence models, such as the American reduction sequence, the Japanese *gihō* ('technique') and more general concepts of artefact life history and design (Bleed 2001; Dobres 2000: 154; Hayden 1998; Shott 2003; Schiffer & Skibo 1987; 1997). Attention is also given to post-depositional processes, post-recovery studies and display (Perlès 1992a; Sellet 1993). Although it is often associated with lithic technology, the *chaîne opératoire* approach is increasingly applied to other materials and activities (Bleed 2001: 106; Dobres 1995, 2000: 181-187; Perlès 1992b; Roux 1990).

While most proponents advocating a social approach to the study of technology agree that the *chaîne opératoire* can be helpful for understanding the cognitive and social meaning of artefacts, opinions vary as to whether and to what degree social meaning can be extrapolated (Dobres 2000: 155-157; Hodder 1990; *contra* Lemonnier 1993, 2004; Trigger 1991). Especially within Palaeolithic studies, the effectiveness of the *chaîne opératoire* for reconstructing mental templates has been extensively discussed (e.g. Karlin & Julien 1994; Pelegrin 1990; Pigeot 1990; Schlanger 1994, 1996). It has also been argued that the concept has remained mostly abstract and restricted to elaborate knapping techniques and elaborately retouched tools (Dobres 2000: 111). Often an unnecessary separation between thought and action is maintained (Edmonds 1995: 9; Ingold 2000: 171; Schlanger 1996; Lemonnier 2004). Mainly for this latter reason and a general difficulty to incorporate the social dimension during the interpretation of the material analysed, Lemonnier (2004) warns both anthropologists and archaeologists alike about the risk of creating 'mythical *chaînes opératoires*', where, despite methodological rigour, the social dimension of the technical act is missing.

Reconstructing step-by-step the physical actions and material procedures by which ancient technicians procured, prepared, modified, shaped, used, exchanged, repaired and discarded their flint artefacts can disclose a wealth of information about their technical knowledge, the different strategies put into place, their level of skill, their problem solving capabilities, individual-group interaction(s) and knowledge sharing (Dobres 2000: 168; Karlin & Julien 1994; Pelegrin *et al.* 1988; Schlanger 1994). What marks the difference between the adoption of the *chaîne opératoire* and other research methodologies is the explicit insistence of the former on the necessity of having a conceptual framework and specific research questions *before* collecting data, i.e. in advance of reconstructing the technological process. Prior to discussing the choice of empirical attributes selected for the present thesis (see further Chapter 4) and why these variables are especially relevant to investigate the relationship between technology and social agency at Rocca di Rivoli, the next section will review how the employment of the *chaîne opératoire* approach in lithic analysis can potentially inform our knowledge of later prehistoric lithics and their knappers.

Lithic studies: procurement, production, use and discard

Raw material procurement, artefact production, use and discard represent the main transformative stages of the *chaîne opératoire*. Each phase represents an analytical step and a set of behaviours or group of actions. As anticipated above and following in the footsteps of Bradley and Edmonds (1993: 11) in addition to others (e.g. Hodder 1982a; Loney 2000), I consider these behaviours as socially embedded, historically-specific acts, whose relationships need to be carefully investigated and defined.

Procurement

Procurement studies include research into raw material sources in terms of their location, availability, distribution, chemical composition and procurement strategies in relation to the organisation of lithic production (e.g. Andrefsky 1994; Bressy *et al.* 2003; Inizan *et al*. 1999, note 27 p. 25; Nelson 1991). The environment is often seen as an external, objective, conditioning factor of lithic procurement (e.g. Andrefsky 1994; Bradbury and Carr 1995; Torrence 1989a; Rozen & Sullivan 1989). Although 'nature' is not held to determine human (technological) behaviour directly, it is still seen as a major constraining factor (Hayden 1998; Trigger 1991: 561). Other factors held to shape the organisation of raw material procurement (and more generally of lithic technology) are subsistence practices, raw material availability and the degree of sedentism/mobility (e.g. Binford 1979; Cowan 1999; Torrence 1986). Local and multi-causal relationships between aspects like core and tool reduction intensity, environmental/climatic changes, artefact transport, site function and duration have also been taken into account (Bamforth 1991; Kelly 1988; Kuhn 1991; Rolland & Dibble 1990). Two types of raw material procurement strategies are generally recognised archaeologically: direct and indirect. In direct procurement strategies raw materials are obtained either through subsistence-related activities or as part of special purpose trips; in indirect procurement, raw materials are acquired via exchange networks (Binford 1979; Ericson 1984).

A central role within lithic procurement analysis is played by the concepts of expediency and curation. Their initial definition was put forward by Binford (1973, 1977, 1979) who described technological organization as a continuum ranging from expedient to curated. Curated technological processes are characterised by tools that are effective for a variety of tasks, are manufactured in anticipation of use, maintained through a number of uses, transported from locality to locality and recycled to other tasks when no longer useful for their original purpose. Technologies based on expedient reduction sequences produce tools that are manufactured, used, and discarded according to immediate needs. Thus, curation should produce assemblages that are technologically sophisticated and formally distinct, whereas expediency is expected to produce assemblages obtained by means of simpler techniques and formally less patterned because tool manufacture is an immediate response to a specific, and sometimes unforeseen need (Binford 1979). These concepts have been further explored by a number of archaeologists studying prehistoric lithic assemblages (Binford & Stone 1985; Kuhn 1995; Andrefsky 1998; Bamforth 1986, 1990; Cowan 1999), and have gradually turned into fixed binary oppositions. Expediency is contrasted with curation, sedentism with mobility, direct with indirect procurement and local with non-local or exotic (Astruc 2005). Procurement for the production of expedient artefacts takes place 'on the go' whilst attending other types of daily tasks, whereas raw material for knapping curated artefacts appears to be obtained predominantly through specially-planned activities carried out outside so-called 'embedded' strategies (Binford 1979: 259). Links between these concepts are often proposed so that 'local' is associated with secondary sources, direct procurement and expedient technologies; whereas non-local or exotic materials are seen as evidence for exchange, craft specialisation, and curated technologies (Binder & Perlès 1990; Johnson 1996; Peterson *et al*. 1997).

With regards to distribution patterns, Binford's original carefully formulated categories have become formalised and opposed entities whereby sites are identified as either base camps or special-task sites (Andrefsky 1998: 201; Binford 1980). In sedentary prehistoric communities, expedient artefacts are often assumed to pertain to the 'domestic' sphere (Edmonds 1995; Rosen 1996, 1997), whereas the presence of non-local/exotic materials is often pointed at as an indicator of craft specialisation (Nassaney 1996; Shafer 1985). This is often linked with the expression of social inequality through control of sources and/or exchange networks (Johnson 1996; Peterson *et al*. 1997).

Binary oppositions are also present in the studies of raw material availability and accessibility. For instance, primary sources are usually restricted in their distribution and often raw material is either deeply buried underground or exposed in high mountainous areas, preventing easy access and necessitating certain skills and tools for retrieval. Secondary sources, in contrast, are more widely dispersed across the landscape, allowing easier access and necessitating less time, effort and skills for their procurement (Barfield 1999, 2000; Bradley & Edmonds 1993; Gardiner 1990; Jeske 1989; Ricklis & Cox 1993). Besides physical constraints, social control can also affect accessibility. This can be organised along the lines of gender, age, kinship or social hierarchy and is not always recognisable in the archaeological record (Burton 1984; Gould & Saggers 1985; McBryde 1984; but see Bradley & Edmonds 1993; Topping 2004).

Binary oppositions, however, ignore the fact that it is often problematic to draw such clear-cut distinctions. They leave little room for the examination of interaction and they tend to assume unambiguous archaeological representations (but see Kelly 1992). The use of 'expedient' and 'curated', has recently been reviewed in the light of a more social-anthropological approach to prehistory: both adjectives have been supplanted by 'simple' and 'elaborate' respectively, which specifically refer to the degree of technical skill involved in the material processes they describe (e.g. Astruc 2005). In addition, they are more and more being considered as forming part of a continuum, often coexisting within the same 'technological system' (e.g. Cornejo & Galarce 2010). This shift in perception is providing new insights on already detailed studies; by exploring the effects of raw material availability (especially in terms of quantity, quality, size and shape) on *chaîne opératoire* characteristics, in particular artefact design (Andrefsky

1994; Bamforth 1990; Bradbury & Carr 1995; Newman 1994; Seeman 1994). Finally, it might potentially throw some light on raw material selection criteria, which some authors have mentioned but not looked at in detail (Bradbury & Carr 1995; Green & Zvelebil 1990; Kuhn 1995: 83; Zvelebil *et al.* 1992).

Production and use

Again, it was Lewis Binford who first questioned the use of differing tool types as cultural markers (Binford 1978; 1979; 1980; Binford & Binford 1966). Although he originally concentrated on Mousterian stone tool assemblage types, the ensuing 'functional argument' (also known as the 'Bordes-Binford' debate; Binford & Binford 1966; Bordes & De Sonneville-Bordes 1970 and continuing with F. Bordes 1981, 1978, 1973, 1972 and L. Binford 1989, 1983, 1973, 1972) has had a broad impact on studies dealing with production and use of lithic artefacts. Tool-type assemblage variability has often been used to infer site functions, activities, occupation span, as well as regional settlement/mobility and subsistence patterns (Rolland & Dibble 1990; Shott 1989b). As a result, lithic studies have greatly expanded conceptually and analytically (Conkey 1990; Perlès 1992b; Sackett 1982: 63-67). Moreover, with the development of sequence models, many studies have examined specific tool production systems, or have concentrated on identifying production-specific variables, artefact classes, often with the use of controlled experimental knapping reproduction (e.g. Ammerman & Feldman 1974; Bleed 1986; Hayden *et al.* 1996; Kelly 1988; Shott 1989a; 1989b; Torrence 1989b). These advances, however, are mostly methodological. It is only with the development of the *chaîne opératoire* approach that matters such as intention, cognition and social topics have come to the fore (e.g. Perlès 1992b; Schlanger 1994).

The binary opposition of 'expediency' *versus* 'curation/craft specialisation' is also present in the context of artefact production and use. Expediency is often associated with 'simple' production techniques and 'unstandardised' tool types, often with negative connotations such as poor, unsystematic, non-specialised, informal. Expedient assemblages are associated with high quantities of raw material which result in assemblages with little modification, highly variable reduction strategies, and high replacement rates (e.g. Bamforth 1986; Binder & Perlès 1990; Chatter 1987; Shott 1996). Curation and craft specialisation are both used to explain 'complex' production and elaborately retouched tools (e.g. Binder & Perlès 1990; Bradely & Edmonds 1993; Topping 2004). Both use similar concepts and language, such as 'standardisation', 'rejuvenation', 'preparation', etc., and as in the case of procurement studies, chronological and socio-political distinctions underlie the main differences between respective explanations and interpretations (e.g. Bradley & Edmonds 1993; Gero 1989; Costin & Hagstrum 1995: table 1).

Craft specialisation has mainly been discussed in later prehistoric contexts, in particular in exchange and social complexity studies, although notable exceptions exist, especially in studies that have examined Upper Palaeolithic blade production using the *chaîne opératoire* approach (e.g. Pigeot 1990; Sinclair 2000). Initially, however, the concept of 'curation', was developed within a specific context, the functionalism argument, within which it was broadly described as "the practice of maximising the utility of tools by carrying them between successive settlements" (Binford 1979: 263). Despite being used rather often, there is still little consensus on its definition, archaeological correlates, associated concepts, or other factors influencing tool morphology. Indeed curation has been employed to describe artefacts (e.g. Shott 1989a, 1996: 266) but also production processes, such as reduction sequences (e.g. Hayden *et al.* 1996; Kelly 1988; Kuhn 1991, 1995; Nash 1996; Odell 1996; Ricklis & Cox 1993).

High degrees of standardisation and skills, increased intensification scale, task-separation of production and tool use, low density and low error rates have all been put forward as archaeological indicators of craft specialisation (Bradley & Edmons 1993; Coslin & Hagstrum 1995; Gero 1989; Nassaney 1996; Perlès 2001: 200-210; Shafer 1985; Torrence 1986). Most studies have focussed on the high end of craft specialisation, primarily dealing with complex reduction sequences and adult male expert knappers (e.g. 'masters/apprentice workshops'); whereas domestic learning contexts, simpler technologies and female knappers have largely been overlooked if not ignored (e.g. Apel 2001; Pelegrin 1990; but see Gero 1991; Lindgren 2003; Weedman 2002).

As briefly anticipated above, the expediency/curation binary opposition has recently been strongly criticised by a group of French scholars working on later prehistoric technology (Astruc 2005; Bailly 2006). They specifically criticise the assumptions underlying the use of the term 'expedient' which, especially when applied to later prehistoric material culture, has come to be equated with 'less technological investment' apparent in the production of debitage flakes (rather than blades) and with tools with a short life span. Such 'expedient' tools co-exist with others produced through more elaborate manufacture processes leading to the production of highly standardised and aesthetically pleasing tools (e.g. bifacially retouched leaf points and knives). Bailly (2006: 36) argues that so-called expedient artefacts "illustrate new modes of uses, new conceptions of tools within society. They ask in a previously unseen way the question of task-specialisation and display technical practices at the heart of domestic routines and cultural transmission".

To study elaborate knapping techniques as conceptually separate from the 'expedient' ones leaves the potential relationship between the two unexplored, particularly when they coexist both spatially and temporally (Astruc 2005; Gero 1991). Both are socially relevant in their own specific contexts and to deny certain artefacts their social potential *a priori* necessarily limits the overall picture and subsequent interpretation (such as Dobres 2000; Ingold 2000: 346, note 4; Robb 1998; Sassaman 2000). This is not to suggest that the interactive practice between material culture and social structure is always archaeologically visible, but more importantly that it potentially exists and that it becomes consciously expressed and perceived by artefact makers/users.

Research into production and use of knapped flint artefacts has greatly benefited from a more anthropological approach, which is increasingly looking into the acquisition and transmission of knowledge and the development of skills. In this regard, a concept which has gradually made its way into archaeology and is widely used in ethnography and anthropology (e.g. Habicht-Mauch *et al.* 2006; Minar and Crown 2001; Starzmann 2013, Stahl 2013), is that of a "community of practice", i.e. "a set of relations among persons, activity, and world, over time and in relation to other tangential and overlapping communities of practice. [...] it is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage" (Lave and Wenger 1991: 98). Applied to the realm of craft production the concept "refers us to the idea that it is usually in such group settings that an apprentice learns the embodied routine of a fully skilled artisan" (Starzmann 2013: 161); cooperation and skill sharing within a community of practice is part and parcel of a wider web of social relations (Ingold 2000). People belonging to these communities of practice share technological skills that are socially transmitted and historically conditioned, i.e. the practice of a certain lithic technology is not just the result of individual impulse but is the consequence of a culture-specific habitus that is anchored to a specific life-world (Starzmann 2013). At the same time, whilst community members share a general understanding of what they are doing, there is also room for the existence of conflicting interests (e.g. artisans of different skill levels or technicians who belong to different communities at the same time) and room for negotiation through enabling members to diverge from the "norm", allowing for variation, although such divergence takes place within socially maintained limits (ibid.).

Fundamental to the understanding of social dynamics linked to the presence of apprentices, is the material expression of skill. In flintknapping, skill is found at the intersection between '*connaissance*' - the knowledgeable practice, cognitive understanding, strategic decision making process and the abstract engagement with what to do next - and *savoir-faire* - practical knowledge influenced by motor skills, dexterity, motivation, fatigue, practice and advice (Pelegrin 1990: 118). The relationship between them changes in terms of experience and the complex interplay of mind and material as each flake is struck (Fig. 2.1). As knappers develop their own practical know-how, they also enter a tactile engagement with flint as a medium and for this very reasons, according to Whittaker (2004), archaeologists should overlook neither the pleasure and rewards of flintknapping nor the physical and mental challenges it creates.

The recent shift towards a social-anthropological approach has also influenced the way in which artefacts are attributed social information. One major achievement from the theoretical

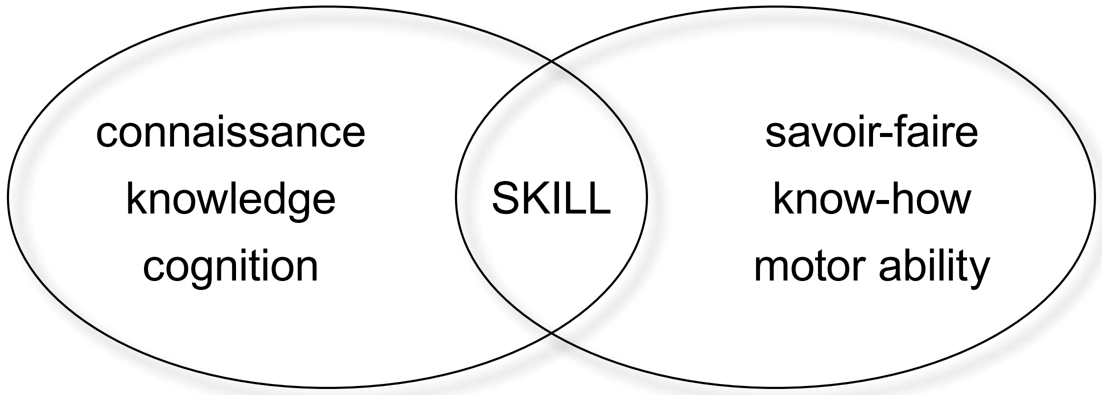


Fig. 2.1. The development of skill at the intersection of knowledge and know-how (from Bamforth & Finlay 2008, fig. 1).

point of view is the abandonment of the style/function dichotomy (e.g. debate around the ‘functional argument’: Binford 1979, 1980; Binford & Binford 1966). Style is no longer seen as a residual feature that may only be explored after functional aspects (such as raw material identification, manufacture and use) have been taken care of. Nor is associated exclusively to a selection of artefacts and/or attributes held capable of transmitting social information (Binford 1986; ‘adjunct’ style in Sackett 1982: 82-104). Rather, style is ‘active’ (contra Sackett’s 1982 distinction between active and passive style) as it is “one of several means of communication through which people negotiate their personal and social identity vis-à-vis others” (Wiessner 1990: 57). However, although most archaeologists would agree that style is “a way of doing something” (cf. Hegmon 1992: 512; Hodder 1990; Sackett 1982; Wiessner 1990) and that it “involves a choice among various alternatives” (cf. Hegmon 1992: 518; David et al. 1988: 365; Wiessner 1990) specifics regarding how style is to be recognised in the archaeological record or how it relates to social and cultural processes are still highly debated.

There are different avenues through which style can be explored in archaeology (power and status, structure and symbolic meaning etc.), but the focus here is on the relationship between technology and style. Style includes technological choices accompanying the individual’s or community’s decision making process. According to Lechtman and Merrill (1977), the concept of technological style takes into consideration not only artefacts but also “the activities which produce the artefacts” (ibid.: 5). Lemonnier too (1986, 1989), although using a slightly different terminology, “technological systems” in place of “technological styles” (pointed out by Hegmon 1991: 529), describes the latter as “signifying systems” used in ethnic and gender relations (Lemonnier 1986: 174).

The relationship between style and technology has important implications in determining which artefact attributes should be included in stylistic analysis and the nature of information that can be retrieved from the study of production systems (Sackett 1982, 1990). Artefact production is no longer to be considered in merely economic terms but can help in understanding the social dynamics contributing to the shaping of artefacts and social relations of production, and, potentially, to gain insights into the stylistic variability detected in the archaeological record, such as the existence of cultural markers as well as local tradition.

Style has almost exclusively been attributed to retouched artefacts, symptomatic of a tendency that equals retouched to the 'finished' object and debitage (or unretouched) to just a transitional step in the knapping process (either potential blank or debris). The division between unretouched and retouched artefacts reflects that between production and use. Although use-wear analysis has questioned the link between use and retouched artefacts, a straightforward 'use-as-function' approach is usually maintained (e.g. Odell 2001), despite recent ethnographic research on artefact variability and intentionality (Hiscock 2004) which cautions against the use=retouch association. In addition, research on elaborate knapping activities and extensively retouched artefacts predominate, presumably also as a consequence of our 'finished artefact fallacy' (Davidson 2002), or the more general distinction between art and technology (Graves-Brown 1995a; Ingold 2000: 348-361). Most lithic specialists have largely neglected the different strategies employed within larger sequences or have overlooked systemisation and variation in simple technologies and unretouched artefacts (but see Edmonds *et al.* 1999; Gero 1989, 1991; Schlanger 1996).

Binary oppositions are ubiquitous in lithic studies, but while heuristically convenient this concentration on two extremes of the same continuum has ultimately restricted research. The need for a more nuanced viewpoint has greatly influenced the conceptual and methodological approach implemented in this thesis. In addition, a number of studies have pointed out that a socially-situated, historically-specific, and engendered perspective on lithic contexts, including local and secondary sources, and simple primary and secondary flaking strategies, is viable and revealing (Astruc 2005; Edmonds *et al.* 1999; Gardiner 2004).

Discard and depositional practices

The way in which archaeological remains (structures, artefacts, animal and human bones etc.) make up patterns of archaeological evidence has received considerable attention in archaeological literature. Since Schiffer's early works (e.g. 1976) archaeological research has, on the one hand concentrated on the study of taphonomy in order to understand natural processes that affect artefact preservation; on the other, efforts have been channelled into identifying past human behaviour (Chapman 2000a; Thomas 1999). In the *chaîne opératoire* approach discard represents the last analytical stage, for example when a flint artefact is no longer used and 'enters' the archaeological record. Prior to post-processualism, abandoned artefacts were often equated with refuse in the archaeological literature (e.g. Hayden & Cannon 1983). Schiffer was the first to discuss different types of refuse (primary, secondary, and *de facto)* and to recognise them in the archaeological record (1976: 38-40). Schiffer's behavioural archaeology also provided a theoretical framework for analysing and describing cultural processes that durable materials go through during their 'lives' (ibid: 27-41). Discard processes are varied and their identification and understanding are both linked to and dependant upon the meaning and value attributed to the action (and decision) of no longer using an object, and of disposing of it in a way which is perceived as appropriate at a specific time and place.

Some archaeologists see discard as a universal human activity that conforms to a uniform set of functional rules (i.e. the effort required to gather the refuse and dump it, its potential recycle value and the obstruction it represents if left where it is, e.g. Hayden & Cannon 1983). Another approach, which has been broadly termed post-processual, has criticised the contemporary western view of refuse, for which all that cannot be reused and is discarded comes to be incorporated in an all-encompassing category, the use-life of which is over and, being contaminated, must be spatially separated from everyday living areas. As Chapman (2000a: 4) pointed out, such attitude is "part of an approach to archaeology which takes the production of artefacts as impersonal, ergonomic relationship between living humans and inert matter, and the distribution of objects as a process of the exchange of goods for goods, valuables for prestige items", and it "reduces the importance of discarded material and diminishes the significance of the means of disposal" (ibid.: 32).

The views criticised by Chapman are, however, gradually making room for an approach which sees human beings as social actors creating, using and manipulating material objects as part of their 'being in the world'. Both ethnographical (e.g. Gould 1980; Hodder 1982a; Moore 1982, 1986) and archaeological research (e.g. Richards & Thomas 1984; Hill 1995; Tilley 1996; Thomas 1999; Chapman 2000; Pollard 2001) has shown that cultural deposition often involves more than the passive discard of material that has reached the end of its use-life. It is possible that some things that leave the realm of daily life may still carry meaning, positive or negative, for the people who used them and that day-to-day, routinized disposal of no longer usable objects operates according to different orders of cultural classification. Deposition from this perspective is both an outcome of culturally specific schemes of symbolic order and a means by which these schemes are reproduced (Hodder 1982a). As social agents, human beings draw upon meanings ascribed to objects, meanings generated through contexts of production, use and association, in order to construct particular material 'statements' through deposition (e.g. Bradley 1990; Pollard 2001).

The later prehistoric evidence from Europe is characterised by formal burial of objects and their structured arrangement in deposits (Bradley 1990; Chapman 2000b; Hill 1995; Thomas 1999: ch. 4). Brück (1999) points out that such practices are indicative of a materiality and rationality in the past which is very different from our own. Depositing things in the ground could have also served on particular occasions as a very deliberate strategy in the negotiation of values: such statements might relate to the identity of places, the definition of different kinds of personhood or being, or the working of relations and obligations (Chapman 1999, 2000a; Chapman & Gaydarska 2007; Pollard 2001).

Intentional deposition of knapped lithic artefacts at Rocca di Rivoli occurred in 29 pits, which were filled with soil, faunal remains, pottery sherds, fragments of querns, knapped flint artefacts and other material (Barfield & Bagolini 1976: 20). Pits have been given significant attention in the narratives of European prehistory, especially in Great Britain (e.g. Thomas 1999; Whittle 1999; Pollard 2001; Garrow 2007; Bradley 2007). In Italy, the presence of pits at Neolithic sites has also been object of a number of recent studies (e.g. Degasperi 1999; Cavulli 2008, Bernabò Brea & Mazzieri 2010) especially in terms of identifying their functional value prior to being filled with the debris of everyday activities (i.e. refuse, another term for these negative structures is in fact "*rifiutaie*"). However, with the exception of a few works (e.g. Cavulli 2008, Pearce 2008) little attention has been given, to practices of pit digging and filling in the Neolithic, or to the cultural meanings and contexts of their deposits.

Within Italian prehistory, although post-processual approaches have largely been ignored, archaeological interpretations appear to be slowly moving away from the equation discarded material=rubbish. Given so, this seems to be still restricted to specific classes of artefacts (such as figurines e.g. Bernabò Brea & Mazzieri 2010).

Theoretical approaches to lithics in Italian archaeology

A very brief overview is given here of current theoretical approaches in Italian late prehistoric lithic studies. Material for putting together this section is very thin on the ground: it is not common in Italian research papers to find a section dedicated to the theoretical concepts underpinning the research methodology adopted or conclusions reached. If such a thing exists it is usually included in the brief section presenting methodological issues which often contains a mixture of theory and practice. There are historical reasons for this, which have been briefly outlined in Chapter 1 (for an exhaustive and provocative *excursus* see Terrenato 2005; a general overview is also provided by Guidi 2000).

In the last ten years publications of later prehistoric lithic assemblages have gradually begun to make use of the *chaîne opératoire* concept, although limited in terms of its analytical role (i.e. more in the sense of reduction sequence), thanks to the introduction of use-wear analysis in the field of Italian Palaeolithic studies (Longo *et al*. 2000-2001). This has in turn stimulated a technological approach to the study of knapped artefacts which has integrated the long standing custom of typological lists (e.g. Dal Santo 2005; Dal Santo & Mazzieri 2014; Ferrari *et* *al.* 2006). At the same time, an overall social-anthropological approach still seems far away, as are research questions that go beyond quantification and description.

Attention is almost exclusively given to raw data, which however are not always systematically presented. In every publication the focus remains on the typological classification of the retouched formal tools. Where technological attributes are recorded or different types of raw material are indicated, these are limited to a description at times very detailed and lengthy as a 'compilation' (*sensu* Dunnel 1971: 23) of carefully collected data. This in turn points to a predominant normative view of prehistory, deeply rooted in culture-historical principles, in which the 'functional' role of artefacts prevails.

There are, however, a few papers which have recently been published or are in press as we speak (e.g. Dal Santo 2009; Dal Santo & Mazzieri 2014, in press) which have applied a *chaîne opératoire* approach providing significant insights as well as results relevant to the present study. For instance, Dal Santo (2005) in presenting results obtained through the adoption of a technological approach to the study of assemblages from Bannia-Palazzine di Sopra, introduces particularly stimulating issues, such as the probable presence of apprentices and the choice of a particular raw material on the basis of a symbolic scheme expressed through colour associations. At the same time, such observations are 'thrown in' at the last minute, avoiding any discussion or further consideration of potentially related symbolic or social aspects, leaving the reader to think for him/herself what to make of them. In general, the adoption of a *chaîne opératoire* approach, turns into the application of a mere reduction sequence analytical method, with almost exclusive focus on the artefact, which makes the identification and description of technological attributes an exercise *per se.* There is no effort in trying to make social sense of the technology under analysis (e.g. Fenu 2005; Moroni Lanfredini 2005; Pistoia 2005).

Undoubtedly this reflects the *status quo* of Italian prehistory studies in general, where attention to 'hard facts' has always been privileged and encouraged. In contrast, the social and symbolic dimensions of prehistoric people are usually confined to their funerary remains and what is held to be unmistakable ritual evidence.

The present approach

The previous pages have pointed out how the adoption of a social approach has changed the study of prehistoric artefacts, bringing back to life not only the techniques used in their manufacture but also the technicians who produced them, their decision making process, their level of skill and knowledge transmission modes. The field of lithic technology, especially for the Palaeolithic period, has greatly benefited from this approach and at the same time has acted as the experimental ground for discussing and testing new research methods (e.g. Schlanger 1996). Inspired by this recent theoretical and methodological shift, the present work embraces a social-anthropological approach to the study of ancient knapped flint artefacts. In order to do so, three main theoretical concepts, which have been discussed in the course of this chapter, constitute the backbone of the present thesis and provide the basis for methodological choices concerning with analysis and interpretation of results.

The first is that technology is central to the understanding of how communities lived and interacted in the past. Technological practice is a unique form of involvement and participation in the world. Following Dobres (2000: 83) technology is considered here as an active verb and an arena for social interaction. Through the exploration of ancient technological practices at Rocca di Rivoli, my goal is to shed light on the still little known end of the Neolithic period in northern Italy, in terms of procurement strategies, knapping tradition and social organization. There is no space here for either technological determinism or somnambulism (see above Pfaffenberger 1988, 1992). Rather, I see the study of the knapped lithic artefacts uncovered at Rocca di Rivoli as a chance to reverse the separation of practice (*techne*) from knowledge (*logos*), already denounced by anthropologists and archaeologists alike (e.g. Dobres 2000; Gero 1991; Ingold 1990; 2000; Pfaffenberger 1988, 1992; Reynolds 1993), and reiterates how the tangible artefact cannot and must not be separated from the intangible actor and practices that created and manipulated it.

The second stance regards technicians (artisans, apprentices, the community at large), the actors of the technological process. They are fundamental in shaping the world around them through their technical acts. Skill, communication, idiosyncrasies, tradition and improvisation, all give structure to technology and at the same time are structured by the very social context they are situated in. To explore agency at Rocca di Rivoli, I will make use of the concept of "community of practice" (see above, Lave and Wenger 1991). The late Neolithic community at Rocca di Rivoli is rethought here in terms of a specific practice, that of flint knapping at the site. Who participated in the production of stone tools? Who shared the technological knowledge? Were there people working together more closely than others (in terms of knowledge sharing)? The identification of recurring practices and routines is the point of departure for exploring further the social dynamics taking place at the site, though efforts will also be made to explore diversity and data falling outside the pattern.

The third and final theoretical stance regards the *chaîne opératoire*: its double nature of conceptual framework and analytical tool holds together material production and social reproduction. As an analytical tool, it enables technical gestures to be reconstructed, step by step, through the analysis of the traces left on the artifacts (platform preparation, presence of cortex, retouch etc.). As a theoretical tool, it prompts the researcher to situate these very traces in a dynamic and articulate social context, within which the unfolding of the technical act is accompanied and guided by a set of principles that are strictly linked to the knappers' skill, status, momentum and overall knowledge of how things are done or should be done. The *chaîne opératoire* makes it possible to look at knapping in its totality, i.e. the technical gestures being enacted (through the visible and tangible traces on the analysed artefacts) and the social context in which the specific gestures are situated. A number of technological attributes (Chapter 4) were selected to be recorded for each of the approximately 8000 pieces analysed in this work with exactly those three specific concepts and a range of research questions (see chapter 1) specific to Rocca di Rivoli and to the late Neolithic of northern Italy in mind.

An additional five key concepts, which have emerged in the course of this chapter and that will occur over and over again along with those just described above (i.e. technology, technicians and *chaîne opératoire*), need to be further defined: practice, knowledge, skill, strategy/style, tradition. As I proceed to explore human choices at Rocca di Rivoli, these five terms will be employed in relation to social interactions and their potential significance.

Practice, whilst often invoked by anthropologists and archaeologists, is rarely explicitly defined, least of all by Bourdieu, who uses it at least in six meanings: 1) practical sense, 2) practical action, 3) practical mastery, 4) domain or system, 5) any (un-)intentional behaviour, performance or occurrence and 6) as emanating from *habitus* (cf. Warde 2004: 5-6, note 1; Bourdieu 1977, 1990: 80-97). *Habitus*, on the other hand, is more clearly defined as a system of dispositions, comprising the result of an organising action, a way of being or a habitual state, and an inclination (Bourdieu 1977: 7, 2-95, also note 1; 1990: 52-65). In archaeology, practice and especially *habitus* are often linked with agency theory (e.g. Dobres 2000: 130, note 3; see Dobres & Robb 2000). Practice is usually described as 1) practical mastery or skill, or in a wider sense as 2) indicating any kind of (un-)conscious (inter-)action. In either usage, *habitus* subsists in practice: people's repeated, reflexive, habitual ([un-]conscious) learnt practices shape, and are shaped by, their daily-life engagement with everything and everyone around them (Ingold 2000: 162-163). That wider meaning of practice is used here and as such, it exists in or is the socially situated connection of knowledge, skills, strategy (technique) and tradition.

Knowledge is often separated into '*savoir*' and '*savoir-faire'*, each accompanied by similar divisions into implicit or explicit learning contexts, action/gesture versus thought, technique or method, and skilled or unskilled knappers (Ingold 1990; Pelegrin 1990). These devices are heuristically convenient (Lemonnier 1983), but as it has been recently pointed out (Edmonds 1995:9; Ingold 2000:162, note 3), a thought/action distinction is difficult to maintain and many different forms and combinations of learning modes and skills coexist.

Similarly, skill is an often invoked, but rarely systematically studied, concept with a multitude of definitions. While diverse, most definitions see skill as a link between practical and abstract knowledge and stress its complex relationships with differing abilities and learning systems. Three archaeological approaches to lithic technology skills have recently been developed: identifying skilled/unskilled knappers, gaining insight into the degree of skill needed to make certain artefacts or sequences, and characterisation of overall skill levels of assemblages (Ingold 2000: 349-361). Here, skill is studied at the assemblage level and is viewed as a flexible process for which a range of archaeological correlates can be explored through comparison.

Strategy is synonymous with technique and indicates the physical realisation of practice. A set of strategies can originate a distinct style or stylistic variation. From the archaeological point of view, a (knapping) technique becomes stylistically significant (and detectable in the archaeological record) when a series of requisites are met (after Chase 1991:200), namely:

1. the technical choice made is arbitrary (i.e. it is one of many possible choices to obtain a given end result or to achieve a given task);
2. it is specific to a limited time and a constrained space (e.g. South France Upper Palaeolithic, Pre-pottery Neolithic A at site XY);
3. it is repeated over and over again by one or more people as to generate clearly identifiable patterns in the archaeological record;
4. it displays some sort of standardization.

Because knapping flint artefacts is learned (and not genetically transmitted), repetitive patterns in the archaeological record indicate a flow of information from one individual to another about how to make an artefact (Hegmon 1992). Regardless of the diagnostic character of style for archaeologists, this is the deliberate effort to express something about the way a certain thing should be done, including status, belonging to a specific community, skill level, etc. etc.

When a stylistic variation in technological practice remains unaltered over a period of time, this can lead to the establishment of a tradition. With the term tradition, archaeologists usually describe historical continuity in the unearthed material culture. Only recently, however, archaeological theory has engaged in a deeper discourse, introducing the role of agency in the creation, maintenance and abandonment of a tradition (e.g. Dobres 2000: 137-140; Robb 2008). Robb (ibid.) for instance, working on statue stelae in prehistoric Italy, argues that traditions arise from specific contexts of action which "provide the conditions within which knowledge is distributed and reproduced" and redefines tradition as "a historical process of continuity of rule-governed practice or knowledge" (ibid.: 348). The possibility of identifying the existence of a technological tradition for the late Neolithic of northern Italy is of particular interest since, to date, little information is available about knapped lithic technology for this period. In Chapter 4 I will present how the theoretical proposal outlined here translated into an analytical methodology.

Chapter 3

ROCCA DI RIVOLI: THE ARCHAEOLOGICAL EVIDENCE

The site and its investigation

The way in which we conduct research, from theoretical approaches to the recording system adopted on site and excavation methods employed, greatly affect retrieval of archaeological data as well as further chances to re-examine the finds. The purpose of the following pages is to present the reader with the archaeological record of Rocca di Rivoli and the ways in which it was put together, conserved and analysed by archaeologists working on it prior to the present study. All these three stages have in one way or another influenced the present work.

The 1963 to 1968 excavations concentrated on the large *dolina* field on the south side of the promontory (Figs. 3.1 and 3.2) known to locals by the name of "Spiazzo" (Pellegrini 1875) and

Fig. 3.1. Rocca di Rivoli and excavated areas between 1963 and 1968 (Google Maps©).

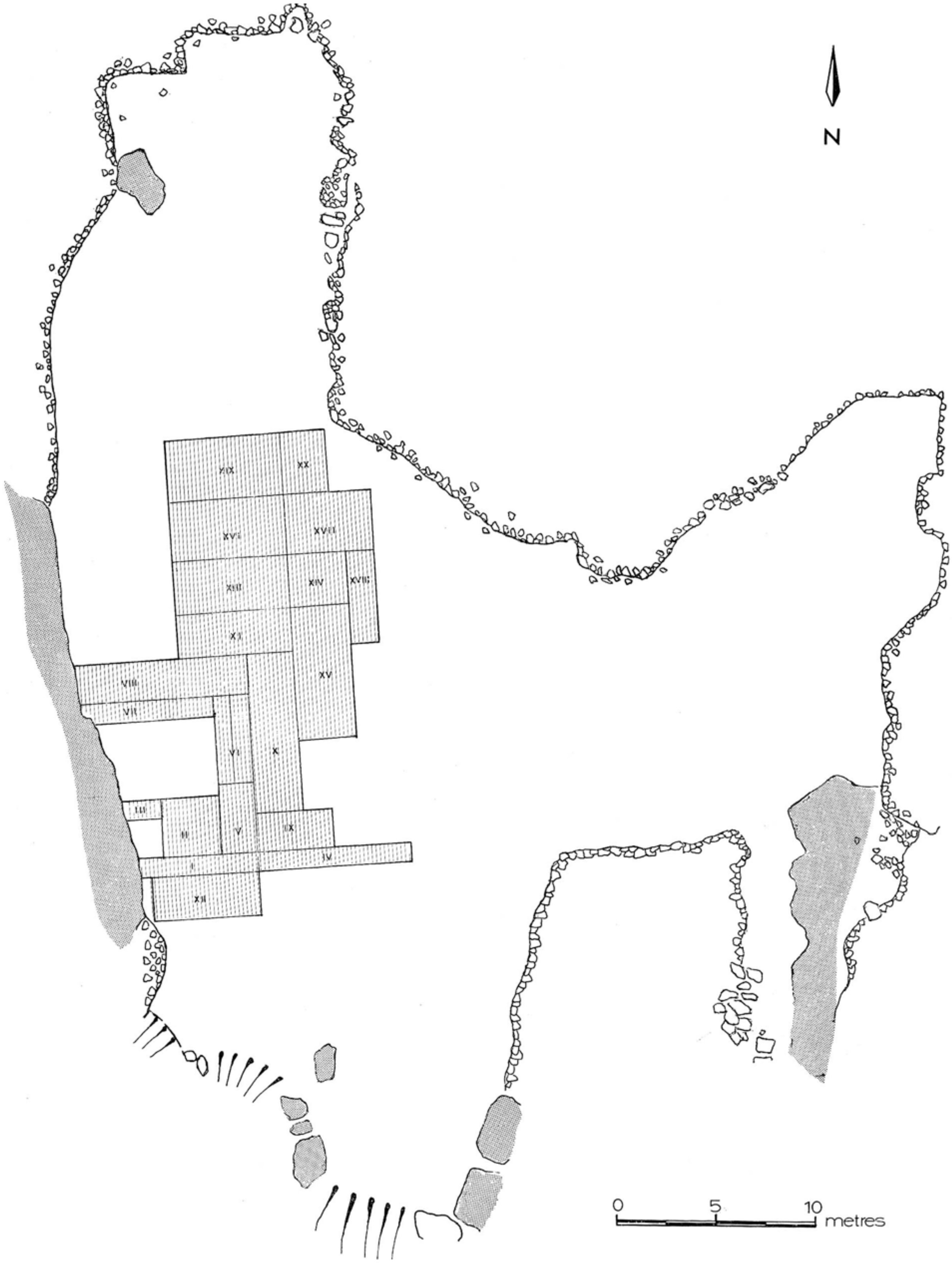


Fig. 3.2. Plan of Site L with 1963 - ’68 excavation trenches (from Barfield & Bagolini 1976, Fig. 3).

named by the excavators as "Site L" (Barfield & Bagolini 1976). Other areas received only minor attention through the digging of minor test trenches (ibid.: 4-5). The present work has taken into consideration only material coming from contexts within Spiazzo or Site L, since it was only here that Neolithic structures were unearthed and systematically recorded. Site L is the only large and flat area (approximately 1300 m^2) relatively free of rocky terrain and boulders on the Rocca (ibid.: 5). The field is irregularly shaped (Fig. 3.1) and slopes down from north to south. The stratigraphy of the site consists of a lowermost gravelly surface (of glacial origin), covered by a horizon of sterile reddish brown, silty clay, above which lies a dark, rich humic deposit containing archaeological remains, of which approximately 1/6 (ca. 220 m^2) was investigated between 1963 and 1968 (ibid.: 5).

Occupation at Site L was found to have taken place during the middle and late Neolithic, early and late Bronze Age, Lombard and Medieval times. The only predominantly intact deposits, however, were those of the late Neolithic and early Bronze Age date (Barfield & Bagolini 1976: 5). The excavators (ibid.) state that "the excavations were complicated by the uniformly black occupation deposits which, even in section, revealed no traces of stratification". Identification of different horizons rested on the presence of stone levels and on datable finds, since the humic deposit was removed spit by spit (5 to 10 cm at a time). Stratigraphy appeared clearer for a series of 29 pits identified on site. These had been dug into the reddish brown soil and into the natural gravel. Medieval ploughing, karst activity and earlier investigations on the site (Pellegrini 1875; Malavolti 1951-1952) are all held to be factors of disturbance. However, whereas the effects of medieval ploughing were confidently observed up to a depth of 0.50m, marked by worn and fragmentary finds, and earlier investigations were easily discerned, nothing is said about potential taphonomical processes linked to karstic activity, of which erosion probably played an important part.

Neolithic traces of occupation were preserved at varying degrees in the form of trodden surfaces, stone levels, postholes, hearths, an interrupted ditch and a series of pits. As anticipated above, Neolithic occupation levels were disturbed by later Bronze Age (and in some instances Medieval) activity taking place at the site. A consequence of such disturbance is the likely re-deposition of Neolithic material into Bronze Age contexts and *vice-versa*. Leaving aside Neolithic surfaces (referred to as "floors" in the records), a brief summary of the main features is given below.

Pits

A total of 29 Neolithic pits were identified on site L (Fig. 3.3). Their dimensions and depth varied, as did their fills (Table 3.1). A number of them were found to have been disturbed by subsequent activity in the early Bronze Age. Out of 29, only 9 were partially excavated. Barfield and Bagolini (1976: 20) identified three main occupation episodes associated with the pit deposits:

1. The earliest phase of occupation is represented by deposits in pits L and H, characterised by pottery with Rivoli-Chiozza type decoration ascribed to the VBQII phase;
2. A second phase, to which the vast majority of pits is ascribed, is associated with Rivoli-Castelnuovo I (VBQIII phase) pottery type (i.e. found in pits A, C, E, F, J, K, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, BB, CC);
3. A last brief episode of occupation is represented by Rivoli-Castelnuovo II (VBQIII phase) pot types in pits B, D and G.

This broad chronology was put forward on the basis of pottery typology and decoration. A more detailed chronology of episodes of pit digging and filling, and therefore a clearer picture in terms of relations among pits is not available. There are, however, four sub-groupings within which intercutting pits are present, and for which, at least on the basis of excavation records, it is possible to identify a number of sub-phases:

1. Group 1; pits U, V, W. Where pit U is cut by pit V. The relationship between pit V and W is unclear in terms of their digging, but it was suggested that they were filled at the same time (Barfield & Bagolini 1976: 7).
2. Group 2; pits P, Q, R, S. Although the relationship between pits S and R is unclear, it is tentatively suggested that pit S was dug and filled last. The relationships among pits P, Q and R are uncertain: pits P and Q could have been dug first, with pit R cutting into them at a later stage. Stratigraphical information for sub-group P, Q and R is not clear and the finds have been considered as coming from one pit complex. This decision has been taken on the basis of the fact that the excavators considered these three pits as part of the same complex and filled in at the same time (ibid.: 12). Pit T to the north of the group is not apparently linked with any of the other features.
3. Group 3; pits L and Z. Pit L is partially cut into by later activity represented by the partially excavated pit Z.
4. Group 4; pits H, J and G, with H being the first feature to be dug and filled. Subsequently the opening and filling of pits J and G took place. The excavators (Barfield & Bagolini 1976: 7) suggest that both pits J and G were filled in at the same time. However, pit G deposits seal the top of pit J (ibid.: 11). In addition, pit G revealed slightly later pottery decoration (Rivoli-Castelnuovo II type) (ibid.: 20). It is therefore likely that pit J and G represent two distinct moments of pit digging and filling. Pit J was dug and filled first. At a later stage pit G was dug, cutting partially into pit J, and filled. The site plan provided here in Figure 3.3 has been modified to take this latter interpretation into account.

As regards pits U, V, W, we are probably looking at two distinct episodes of site occupation. It is impossible to suggest a time lapse between when pit U was dug and filled and when pit V was cut into it and subsequently filled together with nearby pit W. A similar situation is probable for pits P, Q, R, S, with pits P, Q and R being filled in one go (ibid.: 12). Pit S, despite belonging to the same phase (Rivoli Castelnuovo I) can be considered as a separate episode of pit digging and filling as it cuts into pit R. Again, it is unrealistic to suggest a precise time interval between the fill of pits P, Q, R and the digging of pit S. For the time being, what this data tells us is that pits were dug at different times and that some are temporally related, because they were filled at the same time.

Pit L, along with pit H is the earliest feature dug on Site L. Pit H was filled during the earliest phase of occupation of the site (Rivoli-Chiozza, VBQ II) but did not produce any knapped flint. Pit L contained two fills (ibid.: 11). The lower one belongs to the earliest activity on site

Pit	dimensions (metres)	depth (metres)	shape	profile	infill characteristics	fully excavated
A	2.35x1.25	0.60	oval	steep-sided and irregularly flat bottom	balck soil mixed with large glacial pebbles and limestone boulders	yes
B	dia. 1.10	0.45	circular	concave	lower level of light grey clayey soil and ypper level of dark brown soil, both with limestone. The surface of the pit was consolidated with a layer of pebbles	yes
C	dia. 1.20	0.50	oval?	sloping bottom	very fine dark black soil containing several large boulders	no
D	dia. 2.50	0.20	sub-circular	shallow with sloping sides and a flat bottom	lower fill brown stained claywith small stones, upper fill with black occupation deposits with small pebbles	no
E	length 3m	0.40	irregular	shallow	lower fill of stained natural at east side, upper level of black orgnic dill and settlement debris	no
F	dia. 1.50	0.30	circular	concave walls and flat bottom	lower fill settlement debris and stones, upper fill clayey loess	no
G	dia. 4.40	0.50	oval	steep sides and flat bottom	lowest fill grey loamy soil with a few small stones,in-wash, grey soil with stones and occupation debris. Top fill of black occupation level containing many small stones	yes
H	NA	0.20	NA	flat bottom	discoulerd clay subsoil, compact group of stones and pot sherds was found in the central filling	yes
J	dia. 2.25	0.80	circular	steep sides and flat bottom	yellow grey loamy soil with settlement debris and stone sealed by upper fill spread of burnt daub	yes
K	2.25x1.50	0.60	oval irregular	sloping sides and irregular bottom	lower level of grey loam, upper level of black organic soil with stoends and settlement debris	yes
L	length 3.50	0.90	oval irregular	sloping sides and very uneven floor	lower fill very clean clay with stones and settlement debris, upper fill black organic soil	yes
M	dia. 0.80	0.30	circular	rounded	unform black organic soil mixed with stones	yes
N	dia. 1.40	0.30	oval	gently sloping sides	lower fill of discoloured subsoil clay, upper fill of limestone boulders and black soil	yes
O	dia. 1.50	0.40	oval	gently sloping sides	lower fill of black grey occupation debris with stones and fragments of daub, upper fil is similar nut contains large numbers of limestone boulders	yes
P	dia. 1.25	0.70	circular	steep sides and flat bottom	stained loam and large limestone blocks	yes
Q	dia. 1.25	0.70	circular	sloping sides and flat bottom	lowest fill of stained clay, covered by a band of daub which is covered in turn by grey loam and settlement debris	yes
R	length 3.00	0.80	oval	steep sides and flat bottom	lowest fill of grey clay, upper fill black soil with stones	yes
S	length 1.75	0.90	oval	steep sides and flat bottom	lowest fill of grey soil partly covered by in-wash of brown clay, upper fill of black soil and stones	yes
T	dia. 1.00	0.50	circular	steep sides and flat bottom	black soil and a few stones	yes
U	dia. 1.50	0.65	oval	irregular	lowest fill of grey soil, followed by side slip of natural clay and upper fill of black soil and settlement debris.	yes
V	dia. 2.75	0.55	circular	steep sides and flat bottom	lowest fill of dark clay and stones, partly covered by side slip, followed by layer of grey stained clay and uppermost layer of black soil and stones	yes
W	dia. 1.75	0.60	circular	steep sides and flat bottom	lowest fill of dark soil with stones which is covered to the north by side slip. Upper fill of black soil containing an horizon of small pebbles running across into fill of pit V. Carbonised acorns	yes
X	NA	NA	circular?	steep sides and flat bottom	grey and black soil	no
Y	NA	0.50	oval	steep sides and flat bottom	lower fill is of grey loamy soil, side slip, upper fill of balck organic soil	no
Z	NA	1.00	oval	irregular	lower fill thin layer of thin clay, upper fill black occupation soil containing a large quantity of animal bones and stones.	no
AA	dia. 0.50	0.50	circular	NA	black soil	yes
BB	dia. 1.10	0.30	circular	rounded	lower fill of black soil and stones, upper fill of clean black soil.	no
CC	NA	0.20	circular	rounded	black soil and small stones	no

Table 3.1. Rocca di Rivoli, dimensions and characteristics of pits.

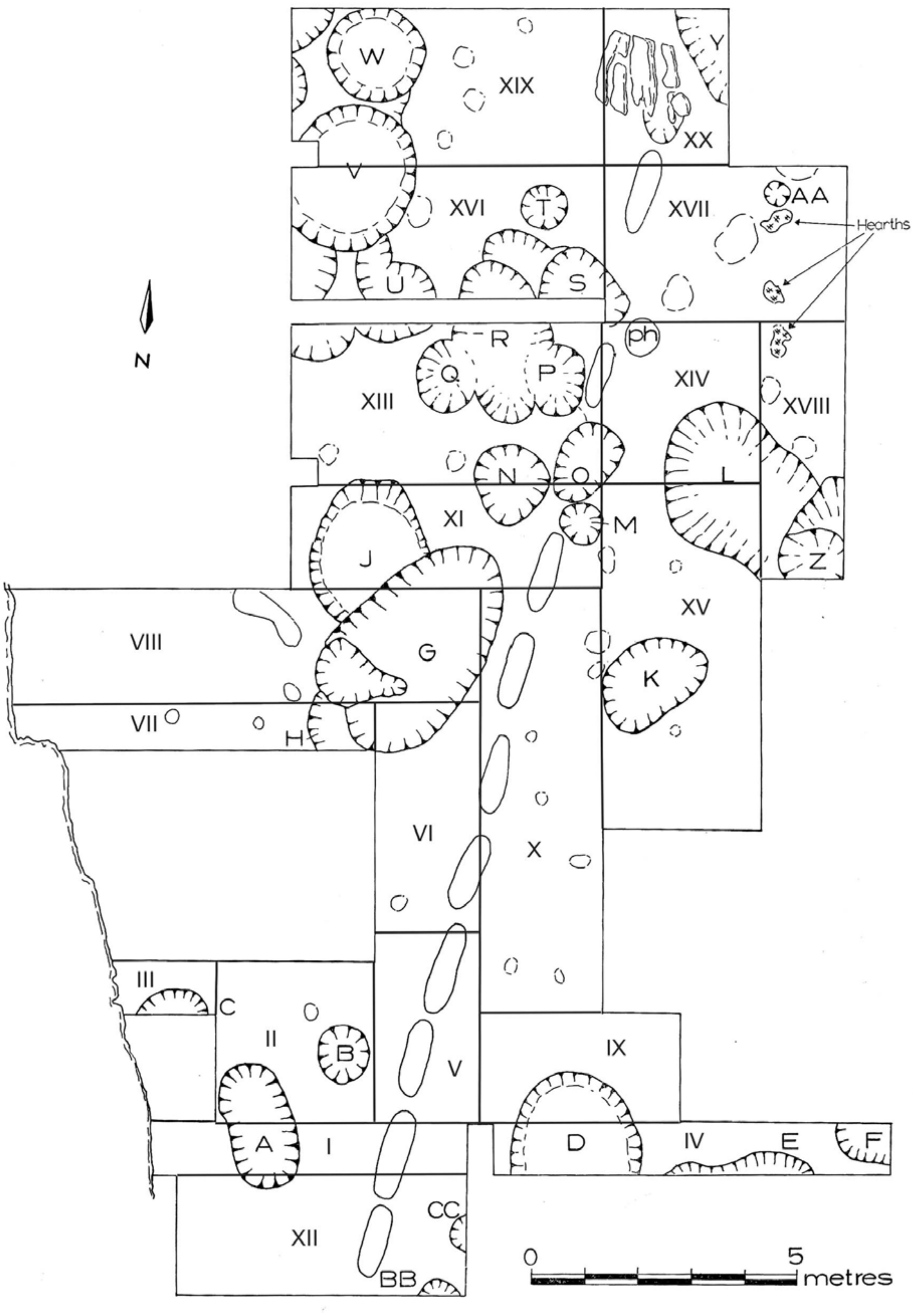


Fig. 3.3. Plan of site with areas and features (modified from Barfield & Bagolini 1976, Fig. 5).

(context XV VIb, Rivoli Chiozza, VBQII) with only a few flint artefacts (52 in total, see Table 6.1). The upper one produced finds belonging to a later phase of occupation (context XV VI, Rivoli Castelnuovo I, VBQIII). In the absence of additional information from the excavation records, it is probable that Pit L was dug first and not completely filled during the earliest phase of occupation (Rivoli Chiozza), but only at a later point (Rivoli Castelnuovo I). An alternative possibility is for pit L to have been dug and filled during the earliest phase of occupation of the site (Rivoli Chiozza) and for a new pit to have been dug into the earliest deposits and filled with later material (Rivoli Castelnuovo I). Unfortunately, lack of additional information such as the presence of a side-slip for the first hypothesis or the identification of a clear cut into earlier deposits for the second, leaves us with an uncertain scenario. A number of pits dug during Rivoli Castelnuovo I phase were subsequently disturbed by later pit digging and filling activity (U, L, P, Q, R, J). However only in the case of pits L and J, did later activity take place at a later stage (with cuts by pit Z and pit G respectively, both belonging to Rivoli Castelnuovo II phase). This necessarily suggests caution in considering the integrity of the deposits of these pits, as disturbance and subsequent contamination is likely, despite the excavators reporting that episodes of contamination were exceptional (Barfield & Bagolini 1976: 20). In both cases (pits L and Z and pits J and G) it was decided to take into consideration only those finds which could be associated with accurate stratigraphic information. For example, in the case of pit Z, bags labelled “Z+L” were not taken into consideration for the present study (see below for sample selection criteria).

Pits are characteristic of the Neolithic archaeological record throughout Europe (Degasperi 1999; Chapman 2000a; Harding 2006). Barfield and Bagolini’s 1976 publication was instrumental in pointing out the shortcomings of traditional archaeological interpretations in Italian prehistory which interpreted pits as the lower part of habitation structures with sunken floors (as early as Chierici 1877; reiterated by Radmilli 1967; slightly modified interpretation with a wooden platform over a pit by Simone & Tiné, eds., 1988: 30-31 and 38-40; Pearce 2008 for a detailed discussion and additional bibliography). In the literature, a distinction is often made between the primary purpose of a pit (e.g. extraction of clay for construction of house walls and pottery, storage etc.) and its secondary function as receiving ‘refuse’ (Thomas 1999: 64; Chapman 2000a: 64). An alternative is to view pits as deliberately dug in order to deposit by-products of activities in and around the house, i.e. as places of deposition (e.g. Thomas 1999: 64-74; Chapman 2000a: 65; Pollard 2001).

It is clearly a deliberate choice to deposit material in pits rather than elsewhere. The contents of the pits at Rocca di Rivoli seem to confirm the deliberate disposal not only of broken pottery, but also lithic artefacts, animal bones, broken quern stones, fragmented *pintadere* and figurines (Barfield & Bagolini 1976: 7-15). The recurring infill is a very distinctive dark organic soil incorporating fragments of daub (pits O and Q), burnt daub (pit J), small pebbles either

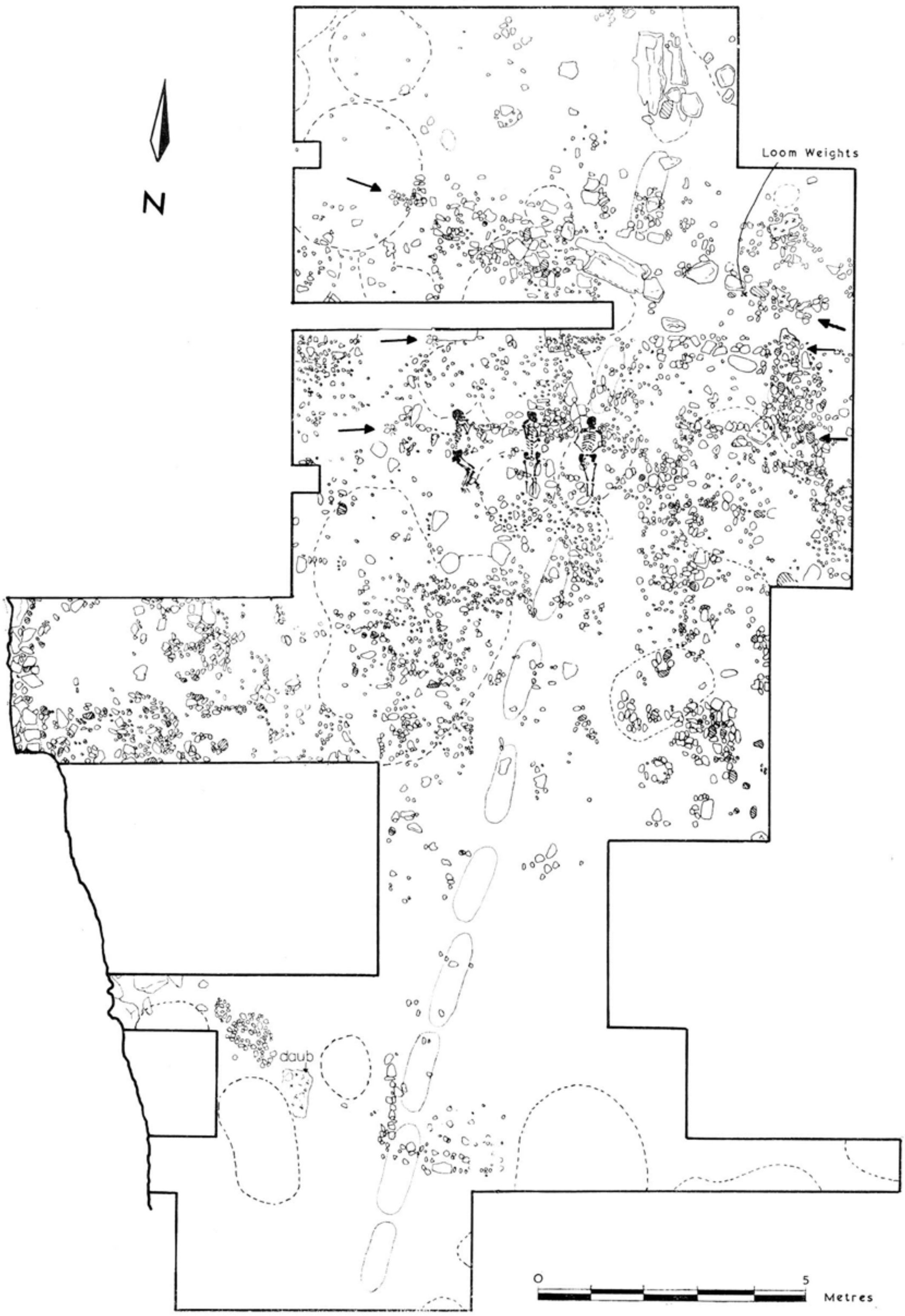


Fig. 3.4. Plan of site L with Neolithic features. Black arrows in the northern half of site (on the eastern and western borders) point at the identified stone alignments (from Barfield & Bagolini 1976, Fig. 4).

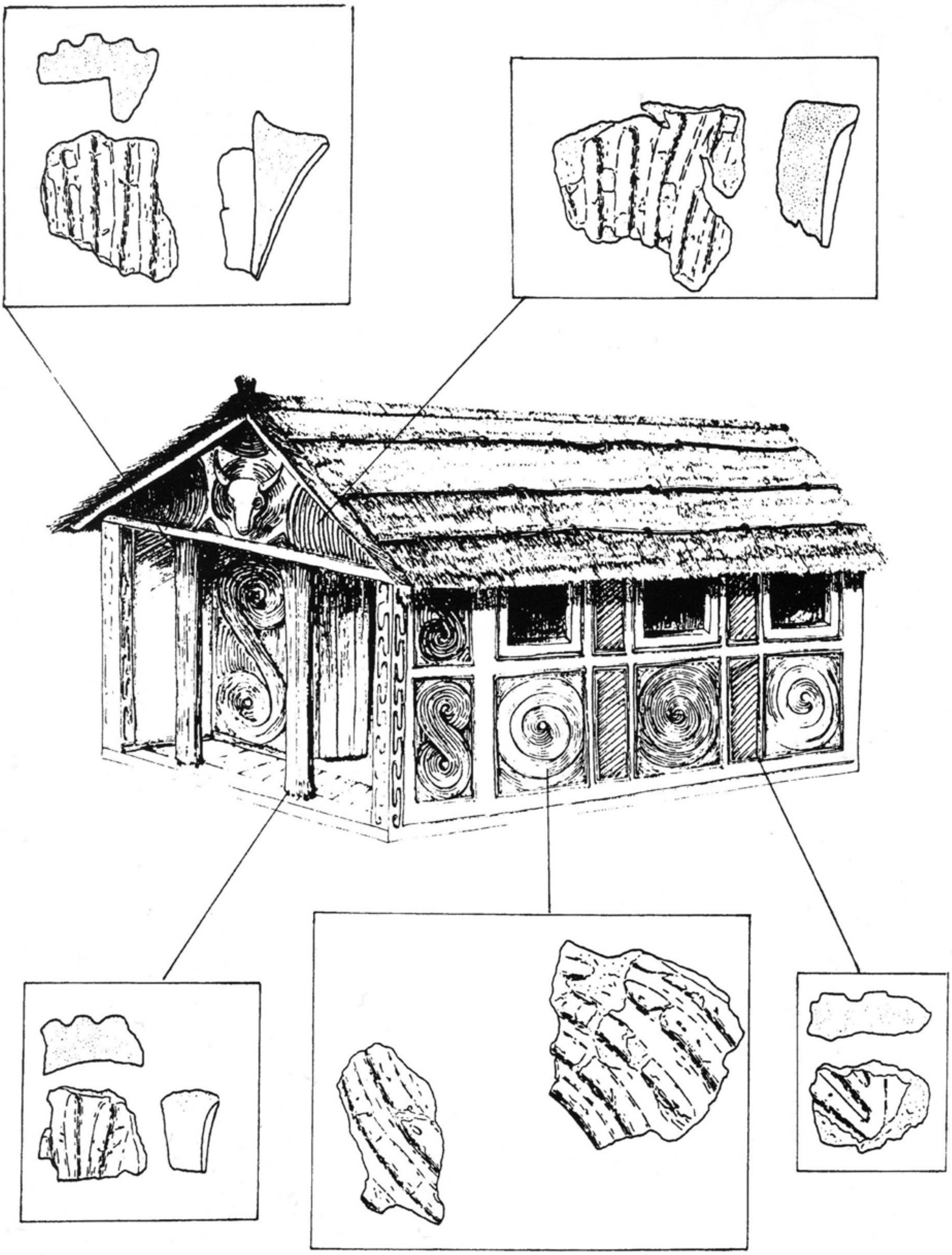


Fig. 3.5. Reconstruction of the Rivoli house by Diana Wardle (from Barfield & Wardle 2005, Fig. 4).


Fig. 3.6. Interrupted ditch segments from SW (photo: L.H. Barfield excavation archive).

consolidating the pit upper surface (pit B) or present in the pit upper layer (pits D, W and V) and in one instance (pit W) burnt acorns (ibid.). The apparent unworn condition of most pottery fragments (Barfield and Bagolini 1976: 20), along with the predominance of orphan sherds in the pits (Dalla Riva 2003), would suggest that these structures may have lain exposed for a very limited time before being filled. The lack of intermediate side slips in all but five pits (Pits G, K, S, W, V, Fig. 3.11), would support this suggestion, reinforcing the argument that these were, for the greater part, filled through pre-meditated and briefly inter-spaced actions.

Chapman (2000c) and Thomas (1999: 64-74), drawing on different regional archaeological evidence, argue that pit-digging may have symbolised a means of contact and exchange with the ancestors represented by earlier cultural layers. Pit filling, in this view, acted as a metaphor for re-incorporation of current material into a context defined by earlier deposits and thus the creation of memory by placing representative residues of events such as feasts, gatherings or periods of occupation in the ground. Thomas, for example, argues that "Pit deposits formed one aspect of the continuous process in which the identities of places were created, re-created and contested" (1999: 72). Italian Neolithic pits, which have received little attention, are mostly interpretated as related to habitation structures and a variety of activities taking place at settlement sites (Bagolini & Biagi 1975a; Bagolini *et al*. 1993b; Cavulli 2008; Degasperi 1999) and thus containing settlement refuse or serving some functional purposes (e.g. claypits, tanning, storage). That there might be other cultural rationales at work in association with pit deposits, rather than simple and straightforward site clearance concerns, was pointed out by Pearce (2008) and has recently timidly surfaced in a few publications (Cavulli 2008; Bernabò Brea & Mazzieri 2010). Bernabò Brea & Mazzieri (ibid.) provide a detailed account of the archaeological record with its fragmented artefacts and striking associations, but there is little investigation of potential cultural practices associated with evident acts of deposition and burial (ibid).

Stone levels & post-holes

Stone levels associated with the Neolithic occupation phase at Rocca di Rivoli were unearthed to the north-east and in the western part of the excavated area. Three lines of larger stone boulders were identified running east-west across the site at roughly 2.50m intervals (Fig. 3.4). The excavators were unsure as to how to interpret such evidence, which might be the product of taphonomic processes (Barfield & Bagolini 1976: 7). Interpretation of such stone rows was only tentatively put forward as stone revetments for possible field terraces, or more simply the rests of levelling of the hill slope in order to provide a flat surface for habitation building (ibid.). A more recent interpretation (Barfield & Wardle 2005) views stone rows as footings for habitation structures built on sill beams (Fig. 3.5). Burnt clay was incorporated into two of these stone rows and one stone line appears to run between pit N and pit group PQR as far as the northern end of pit L, where traces of daub and a large limestone block were set on the lip of the pit (Barfield & Bagolini 1976: 7). There are presently no parallels from other VBQ sites supporting the interpretation provided by Barfield and Wardle (2005).

The interrupted ditch

An interrupted linear ditch ran across the site for approximately 22m, cutting the site in half on a north-south axis (Figs. 3.3 and 3.6). Ditch segments were uniform in shape and dimensions and spaced at roughly regular intervals. Such regularity is broken near pit S, where distance between the last two excavated ditch sections increases. According to the excavators (Barfield & Bagolini 1976: 17) this might have been caused by the presence of a large stone boulder set into the upper surface of pit S. On the basis of such evidence, it was suggested that the interrupted ditch came after pit S or that the construction of the segmented ditch respected already present features related to the use of pit S. Unlike the Neolithic pits which contained settlement debris, the segments of the interrupted ditch were almost devoid of finds and did not present the characteristic dark organic fill frequently recorded for the pits (ibid.: 17).

Pit	L	A	BB	C	CC	E	F	J	K	M	N	O	P	Q	R	PQR	S	T	U	V	W	V+W	X	Y	Z	Z+L	DITCH	B	D	G
complete artefacts	234	117	52	30	17	3	15	106	141	75	101	246	63	125	237	136	168	19	53	463	219	49	61	72	178	111	48	47	140	643
cores	16	1	10		1	1	1	11	6	3	3	20	10	4	14	4	9		5	32	11	3	2	1	21	5	1		3	51
ravvivamenti	3							1	2			12	3	1	3	1	3		1	12	4		1	1	4	1				9
retouched artefacts	45	24	27	7	13	2	2	53	36	7	9	61	21	57	55	27	39	12	47	112	44	7	11	23	60	28	6	4	80	368
splintered pieces	1	1							1		1	2	1	1	1	1	1			7				1	1				1	8
burin spalls	2								1			3		3	2		1		1	3	1				1					5
BURINS	**6**	**1**	**5**	**1**	**1**	**0**	**0**	**2**	**1**	**0**	**0**	**7**	**2**	**4**	**1**	**1**	**3**	**2**	**1**	**11**	**7**	**0**	**0**	**3**	**8**	**5**	**1**	**3**	**5**	**21**
semplice a uno stacco	1		3	1				1	1			1		1			2			5	1			1	1	1	1	2	3	3
su frattura	3		2		1							3	1	3		1	1		1	3	3				2	2			1	5
su ritocco a ritocco d'arresto	1																													
multiplo	1																				1				1					2
su ritocco trasversale a stacco laterale		1																1							1					3
su ritocco laterale a stacco laterale												1	1											1						4
su ritocco laterale a stacco trasversale								1													1			1				1		1
a due stacchi laterale e trasversale												2								1					2	1				1
semplice a due stacchi laterali															1			1		2	1				1	1			1	2
SCRAPERS	**5**	**3**	**3**	**1**	**1**	**0**	**0**	**1**	**2**	**0**	**0**	**9**	**3**	**8**	**3**	**1**	**1**	**1**	**3**	**8**	**3**	**0**	**2**	**3**	**8**	**5**	**1**	**0**	**8**	**26**
frontale lungo	1	2	3					1				4	1	1		1	1	1	2	4	2				3	1			3	2
frontale lungo a ritocco laterale																				2					2	1			2	5
frontale corto	3								1					2	2				1	2				1					1	11
frontale corto a ritocco laterale				1								2		2									1		2	2	1			1
a muso ogivale									1			1	1	1										2						3
a muso isolato												1									1									
carenato frontale	1	1			1							1		2	1								1		1	1			1	1
carenato a muso																													1	3
multiplo G4.G6													1																	
ABRUPTLY RETOUCHED	**2**	**2**	**3**	**0**	**0**	**0**	**0**	**6**	**1**	**0**	**0**	**1**	**1**	**6**	**2**	**1**	**4**	**0**	**1**	**0**	**5**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**10**	**19**
troncatura marginale	2	1	3					3				1		1	1		3				2				1				7	3
troncatura profonda normale		1						1	1				1	1	1		1		1		3									11
troncatura profonda obliqua								2						3		1									1				3	4
troncatura multipla														1																1
AWLS	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**11**
becco punta														1																5
becco troncatura																				1										5
becco multiplo																														1
BACKED BLADES	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**18**
lama a dorso marginale	1													1					1	1					3					10
lama a dorso profondo LD2.LD2		1										2													2					2
lama a dorso e troncatura obliqua ad angolo ottuso																				1										1
lama a dorso e troncatura obliqua ad angolo acuto																														1
lama a dorso e troncatura normale																														3
punta a dorso totale																				1										
punta a dorso marginale																					1									
punta a dorso parziale rettilineo																					1									
punta a dorso e troncatura normale																					1									1
FLAT RETOUCHED	**6**	**6**	**4**	**3**	**2**	**2**	**1**	**7**	**5**	**2**	**3**	**5**	**4**	**6**	**7**	**3**	**6**	**0**	**3**	**18**	**7**	**4**	**1**	**0**	**13**	**4**	**0**	**0**	**8**	**42**
punta foliata a base arrotondata	2	3	2	2	1	1		1	1	1		2		1	1	1	1		1	4	1	2			3	2			2	13
punta foliata a base semplice																														1
punta foliata doppia a foglia	1	1					1														1									
punta foliata doppia a losanga																														1

Pit	L	A	BB	C	CC	E	F	J	K	M	N	O	P	Q	R	PQR	S	T	U	V	W	V+W	X	Y	Z	Z+L	DITCH	B	D	G
punta foliata semplice		1																												
punta foliata semplice assiale		1						1			1	1	1	2		1				4	2	1	1		4				1	2
punta foliata semplice trasversale														1						2										
punta foliata a peduncolo semplice									1					1			1			1										2
punta foliata a peduncolo e spalle																					1				1				1	7
ogiva foliata semplice	1							1	1		1		1		1		1			3	1	1			2				1	7
ogiva foliata a base arrotondata								1								1	1													
punta foliata a base semplice								1																						
foliato a tranciante trasversale triangolare																														1
foliato multiplo												1													1					
raschiatoio foliato semplice trasversale	2				1								2																	
raschiatoio foliato semplice			2	1		1		2	1	1	1	1		1	5		2		2	4	1				2	1			3	7
raschiatoio foliato doppio									1																	1				1
POINTS	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**1**	**2**	**0**	**1**	**1**	**1**	**1**	**6**	**1**	**0**	**0**	**0**	**4**	**1**	**0**	**0**	**1**	**14**
punta marginale	1	1						1				1	1	1				1		4					1	1				2
punta profonda curva	1																													
punta profonda diritta								1						1					1	2					3				1	6
punta carenoide												1				1	1				1									5
punta multipla																														1
SIDE SCRAPERS	**14**	**6**	**7**	**1**	**0**	**0**	**1**	**17**	**8**	**2**	**3**	**3**	**4**	**2**	**18**	**11**	**4**	**5**	**19**	**25**	**14**	**3**	**5**	**8**	**5**	**5**	**2**	**1**	**22**	**119**
lama raschiatoio profondo		2										1			2	1				1						1			4	7
lama raschiatoio marginale	9	2	1	1			1	9	3	2	3	1		1	10	3	3	1	3	14	8	2	3	3	3	3	1	1	3	71
lama raschiatoio carenoide															1	1													1	2
raschiatoio marginale	2	1	5					4	4			1	3	1	3	2	1	2	16	6	4		1	3	2	1	1		10	15
raschiatoio profondo laterale	2	1	1					2	1				1		2	4		2		2	1	1		2					4	7
raschiatoio profondo trasversale	1																			1										9
raschiatoio latero-trasversale								1													1		1							7
raschiatoio carenoide								1												1										1
RETOUCHED FLAKES	**2**	**1**	**1**	**1**	**2**	**0**	**0**	**6**	**3**	**1**	**0**	**7**	**0**	**10**	**8**	**2**	**5**	**0**	**3**	**0**	**1**	**0**	**0**	**1**	**4**	**0**	**0**	**1**	**8**	**31**
scheggia a ritocco erto marginale	1		1	1	2			4	3	1		6		6	6	1	5		1		1				2			1	5	17
scheggia a ritocco erto profondo	1	1						2				1		4	2	1			2					1	2				3	14
DENTICULATED	**7**	**3**	**4**	**0**	**4**	**0**	**0**	**7**	**13**	**0**	**3**	**8**	**3**	**12**	**14**	**4**	**12**	**3**	**12**	**23**	**2**	**0**	**3**	**8**	**8**	**6**	**2**	**0**	**14**	**53**
denticolato piatto incavo	1	2	3		1			5	4		1	3		7	4	1	2	1	2	9	1		2	4	2	1	1		8	16
denticolato piatto punta	1								3			1	1		2		2		1	2					1	1			1	4
denticolato piatto grattatoio	1								1				2		3	1	1		3	1					1					7
denticolato piatto raschiatoio			1						5		1	3		1	2		4	2	5	3	1			1	1	2			4	6
denticolato carenoide punta														1						1				1		1			1	3
denticolato carenoide incavo														3			1			2					2					5
denticolato carenoide grattatoio								1			1	1			2	1	1		1	2			1	1		1	1			9
denticolato carenoide raschiatoio	4	1			3			1							1	1	1			3				1	1					3
OTHER TOOLS					**2**			**3**				**1**	**1**	**3**	**2**		**2**		**3**	**3**	**2**				**3**	**2**			**4**	**13**
strumenti compositi								2				1		3	1		2		2	2	1				2	1			1	5
strumenti a ritocco sommario					2			1					1		1				1	1	1				1	1			3	8
TOTAL	45	24	27	7	12	2	2	51	33	5	9	45	19	55	55	24	38	12	47	98	45	7	11	23	60	28	6	5	80	367

Table 3.2. Overview of Bagolini’s selected sample: Neolithic pit contexts only.

Ratio length/width	Artefact type
>6	Micro-blade
≤6 and >3	Bladelet
≤3 and >2	Blade
≤2 and > 3/2	Blade-like-flake
≤3/2	Flake
≤1 and >3/4	Large flake
≤3/4 and ≥1/2	Very large flake
<1/2	Macro-flake

Table 3.3. Artefact categories commonly employed in the analysis of Italian prehistoric flint assemblages (from Bagolini 1968).

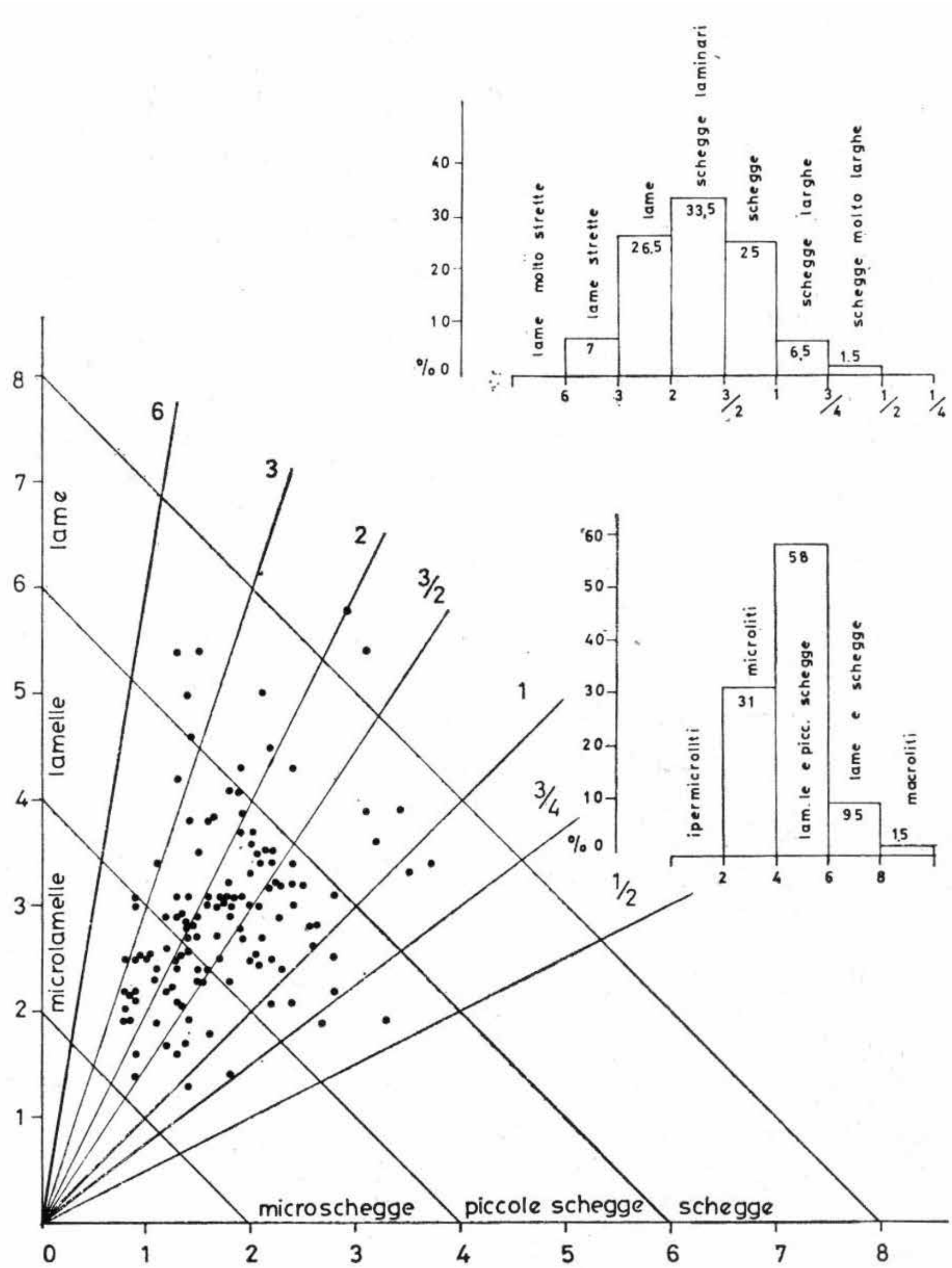


Fig. 3.7. Example of Bagolini’s scatter diagram resulting from the plotting of length and width of complete artefacts (from Barfield & Bagolini 1976, Fig. 65).

At the time of the 1976 publication the interpretation of this feature was uncertain but it was suggested that it held some kind of fence (ibid.: 17). According to later re-interpretation of the feature by Barfield (2000), the idea of a fence would still seem the most probable explanation, especially in the light of the widespread use of wattle panels in the Neolithic and later prehistoric Europe (Coles & Orme 1977: 29). Ditch segments dimensions would fit in with dimensions of the panels unearthed at the Neolithic Walton track in the Somerset levels (these measured 1.50m x 2.7m in length; ibid.: 14).

The ditch alignment at Rocca di Rivoli can also be compared with the alignments of similarly spaced shallow pits found on Chasseén sites in south-eastern France (e.g. St. Michel du Touch and Villeneuve Tolosane) (Barfield 2000). However, these are generally longer (more than 5m) and wider than those unearthed at Rivoli and are filled with fire-cracked stones. Their current interpretation is as sites for cooking in association with periodic feasting. Stone-filled pits, which might be compared to the Chasseén sites, were excavated at the Neolithic sites of Mileto (Sarti & Martini 1993) and S. Andrea di Travo (Bernabò Brea *et al*. 1994). However, although these have been interpreted as cooking sites (S. Andrea di Travo) and pottery kilns (Mileto), they do not occur as part of an alignment. Features at Rocca di Rivoli, because of their size, would not have been suited to be cooking pits, nor were fire-cracked stones found in them.

The interpretation of a possible fence or palisade system would imply the creation of a defined space, or a boundary separating two distinct areas on either side. Such spaces, better known as enclosures elsewhere in Europe (e.g. Britain, Ireland, France, see papers in Varndell & Topping 2000), have often been interpreted as the arena for display and deposition, for negotiation of values, relationships and ideas (ibid.). It is striking that excavation of the segments did not produce any artefacts, in contrast to the pits which were filled with the debris of activities taking place at the site. It would appears that the foundation of the actual boundary had purposely been kept clear of and separate from the material culture associated with display and deposition practices which seem to characterise the pit groups at the site.

Hearths

Remains of Neolithic hearths, represented by burnt clay, were found in the north-east of the excavated area (Fig. 3.3). Other hearth structures were interpreted as Bronze Age in date since they lay directly below Bronze Age material. Sparse fragments of burnt clay were found also in the eastern part of the excavated area, but these remain isolated from potential hearth structures and have been tentatively interpreted in association with possible habitation structures and the stone alignments (Barfield & Bagolini 1976: 17).

Preservation of the archaeological evidence from Rocca di Rivoli is, at best, patchy. There are 29 pits for the Neolithic but no preserved hearths *in situ* or features which point in the direction of habitation structures. Pits are filled with unworn pottery sherds and flints but refits, despite several attempts, were not found (Barfield & Bagolini 1976: 20). There is an interrupted ditch cutting the site N-S but its stratigraphic relationship to the rest of the pits is far from clear, with the exception of the relationship with pit S which reveals how the latter possibly belongs to an earlier phase. Taphonomical processes as well as later disturbance have undoubtedly affected the degree of preservation and left a far from complete picture of the structural features once present at the site. Neolithic pit fills, with the exception of a very few which have not been included here, remain the only near-intact deposits, providing archaeological material culture suitable for exploring late Neolithic flint knapping technology.

Rocca di Rivoli flint artefacts

Flint artefacts were retrieved in abundance during the four-year digging period at Rocca di Rivoli. Approximately 210 kg are believed to have been recovered (see below). Bagolini (Barfield & Bagolini 1976: 75-126) undertook analysis of a sample of the Neolithic, early and late Bronze Age deposits (Table 3.2)\. A total of 4280 complete artefacts from pit contexts were studied, including cores, formally retouched artefacts, complete debitage (blades, bladelets and flakes) and burin spalls (ibid.).

Two types of analysis were undertaken by Bagolini: typological and typometrical. The first adopted Laplace's (1964) classification criteria for retouched tools, augmented by additional typological classes for flatly retouched artefacts (i.e. *foliati*) developed by Bagolini himself (1970). The second analytical method proceeded to plot length-width ratios of whole artefacts onto charts like the one reproduced here in Figure 3.7. Starting from criteria formerly defined by Tixier (1963), Bagolini (1968), undertook a comparative study of flint finds coming from Italian prehistoric sites (from the Palaeolithic to the Neolithic) and defined different types of flakes and blades on the basis of the length/width ratio, as shown in Table 3.3 above.

Such categories were also employed at Rocca di Rivoli for the typometric analysis of complete debitage pieces (Barfield & Bagolini 1976: 75-126). The scatter plots present rather clearly the distribution of artefacts dimension and types (length-width ratio). According to Bagolini (ibid.: 65-126) Bronze Age flint assemblages are characterised by flint types which were defined "drier" (ibid.: 65) and of poorer quality when compared to those found in Neolithic deposits at Rocca di Rivoli. He also noticed how, when considering the bulk of the debitage of the two periods, flint colour variability diminished greatly within the Bronze Age deposits. At the same time, formal tools, especially those which make us suppose a degree of technical investment (e.g. quality and extent of retouch) were still obtained by knapping high quality flint types (ibid.: 121).

Bagolini’s 1976 work identified the main types of retouched tools and tool groups. Figure 3.8 presents percentage values of different types of tool groups from pit L (VBQII deposits, earliest occupation phase). Side-scrapers (32%) are the most abundant category, followed by denticulated tools (16%), burins (14%), flatly retouched artefacts (*foliati*) (13%) and long and short end-scrapers (11%).

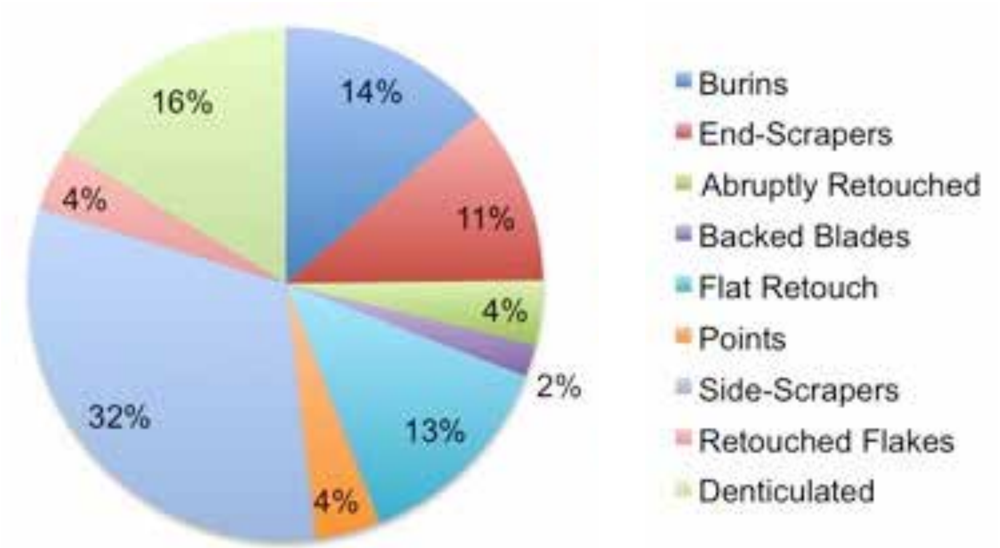


Fig. 3.8. Pie chart showing percentages retouched artefact types in Chiozza layer of Pit L according to Bagolini’s 1976 analysis.

Pits ascribed to the subsequent occupational phase (Rivoli-Castelnuovo I), provided the majority of finds for the Neolithic period. This assemblage is presented in Figure 3.9. The most abundant tool category is still the side-scraper (23.8%), followed by denticulated (20.6%) and flatly retouched tools (15.7%), burins (8.9%), end-scrapers (9.3%) and retouched flakes (7.6%).

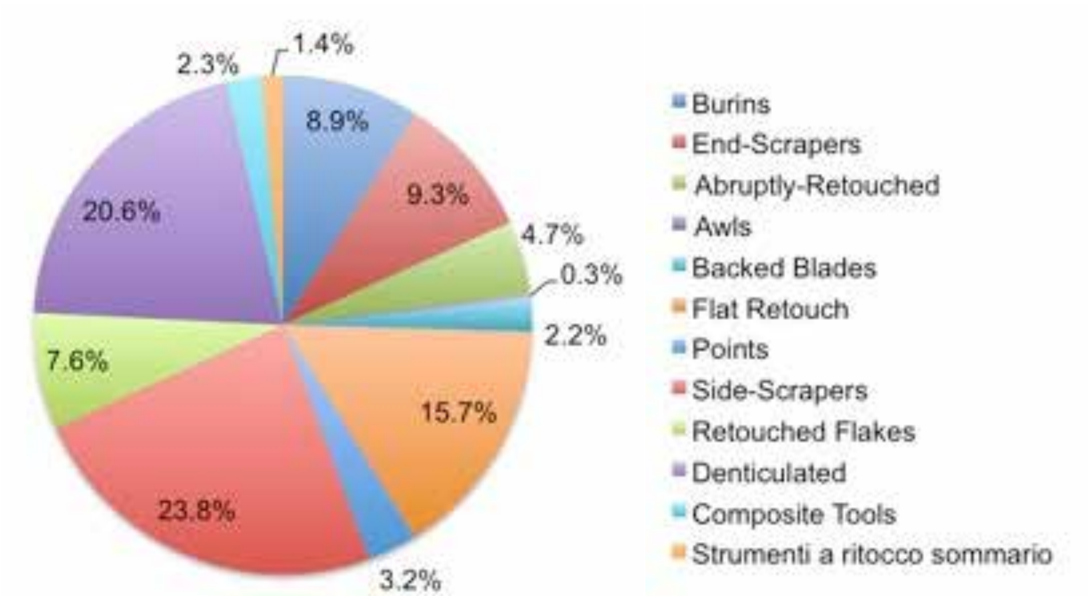


Fig. 3.9. Pie chart showing percentages retouched artefact types coming from Rivoli Castelnuovo I pit contexts according to Bagolini’s 1976 analysis.

Finally, the lithic assemblage from pits belonging to the Rivoli-Castelnuovo II phase (Fig. 3.10) confirms once again the predominance of side-scrapers (31.4%), followed at some distance by denticulated (14.8%) and flatly retouched tools (11.1%). Retouched flakes (8.8%) and abruptly retouched tools (6.4%) are present in higher numbers when compared to assemblages coming from previous phases. Burins (6.4%) and end-scrapers (7.5%) have both decreased.

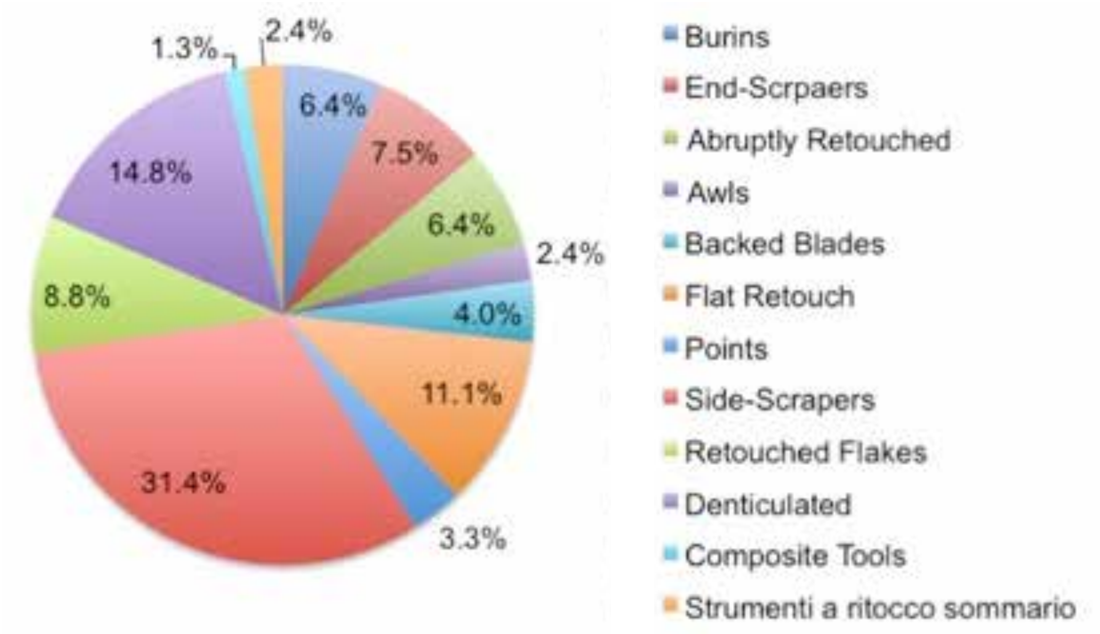


Fig. 3.10. Pie chart illustrating retouched artefact types coming from Rivoli Castelnuovo II pit contexts according to Bagolini's 1976 analysis.

Tool categories employed in the charts come from Bagolini's subdivision criteria, based on Laplace's (1964) main groups. However, by grouping artefacts in this way, details regarding individual artefact distribution patterns are likely to be overlooked. For instance, Bagolini includes sickle blades (artefacts retouched on one side or both sides) in the side-scrapers categories (Barfield & Bagolini 1976: 123). In addition, the *foliati* subgroup includes flatly retouched points, but also wide side-scrapers: the focus in such subdivision rests on the flat retouch. The assemblage from pit L already displays a considerable use of the flat retouch technique, which has now been documented at other VBQII sites (e.g. La Vela).

Finally, as regards the overall structure of flint assemblages belonging to the three different phases, typometric analysis undertaken by Bagolini (Barfield & Bagolini 1976: 123-175) indicated that all debitage from the three assemblages is dominated by flakes over blades and by small and microlithic artefacts. When looking closer at the types of artefacts coming from individual pits, there are also differences which Bagolini interpreted as probably linked to different types of activity areas (ibid.).

In conclusion, the study of flint artefacts by Bagolini was carried out according to standards and research questions of the time (see Chapter 1). The main objective of the 1976 publication of

Pit	Area	Layer	Bag nos.	present in DB	present in publication	present in records	Subtotal
A		[I]		N	Y	Y	
		(5a)		Y	N	Y	
	I	(6)		Y	Y	Y	
	II	[V]		N	Y	Y	250
D	IV	(7c)	486, 487, 540, 54	Y	Y	Y	
		(8b)	348	Y	N	Y	
		(12)	491, 492, 546, 547	Y	Y	Y	
		(12a)	493, 540, 543	Y	N	Y	
		(13)	493, 494, 548	Y	Y	Y	
		(13a)	495	Y	N	Y	
	IV	[XVIII]	549, 550, 459	Y	Y	Y	
	IV-IX	(7c)		Y	N	Y	471
G	VI	(5)	457, 458	Y	Y	Y	
		(8)	505, 506	Y	Y	Y	
		(10)	44, 45, 455, 456, s	Y	Y	Y	
		(11)	406, 407	Y	Y	Y	
		[IV]	511, 512	Y	N	Y	
	VII	(5)	321, 362	Y	Y	Y	
		(8)	506	N	N	Y	
	VI/VIII	VIII (3)		Y	Y	Y	
	VIII	(7a)		Y	Y	Y	
		(8)	328, 329	Y	Y	Y	
		(9)		Y	Y	Y	
		(11)		Y	Y	Y	
		(13)	460	Y	Y	Y	
		(14)	462	Y	Y	Y	
		Pit G		Y	N	Y	
		(17)	219, 254, 255	Y	Y	Y	
		[IX]	470, 471	Y	Y	Y	
		[IX] (4)		N	Y	N	
		[IX] (3)		N	Y	N	
		[IX] (5)		N	Y	Y	
	VIII/XI	5	246	Y	Y	Y	
		6	239	Y	N	Y	956
J	VIII	(12)	459	Y	Y	Y	
		(16)	(only tools)	Y	Y	Y	
		(19)	466, M27	Y	N	Y	
	VIII/XI	(7)	232	Y	Y	Y	
	XI	Pit J	M27	Y	N	N	
		(11)	M36, 235*	Y	Y	Y	
		(12) and 2 (12)	243	Y	Y	Y	544
K	XV	[IV]	104, 220, 418, 44	Y	Y	Y	583
L	XV	[VI]	136, 220, 236, 51	Y	Y	Y	
		[VIa]	6A Bag 593	N	Y	Y	
		[VIb]	328, 404, 496, 23	Y	Y	Y	
	XVIII	(14)	238, 277, 330, 44	Y	Y	Y	705
M	XI	[VII]	196, 245	Y	Y	Y	102
N	XI	[VI]	89, 367, 350	Y	Y	Y	
	XIII	[XIIIp]	517	Y	Y	Y	86
O	XIII	[XIp]	not found	N	Y	Y	
		[IIIA] P		Y	N	Y	
		[VI] P	133, 231, 238, 27	Y	N	Y	
		[VI] P lot B	238	Y	N	Y	
		[VI] P layer below	362	Y	N	Y	
	XII	[Via] p	not found	N	Y	Y	508
PQR	XIII	[VI] A (P)	596	Y	N	Y	
		[VII] P	94, 223, 426, 561,	Y	Y	Y	
		[VIIA]	358	Y	Y	Y	
		[VIIB]	508	Y	Y	Y	
		[XI] A&B	657, 363, 364	Y	Y	Y	
		[IXp]	590	Y	Y	Y	
		[XIIA]	515	Y	Y	Y	
		[XIIB]	425	Y	N	Y	1601
S		(5)	299, 381, 557	Y	Y	Y	
	XVI	[VIIa]	464	Y	Y	Y	
	XVII	[X]	287	Y	N	Y	319
T	XVI	[IX]	450	Y	Y	Y	44
U	XVI	[IV]	387, 475, 544, 57	Y	Y	Y	
		[V]	518	Y	N	Y	
		[IIIp]	95	Y	N	Y	
	XIII	[V]		N	N	Y	233
V	XVI	[I]	466, 476, 510	Y	Y	Y	
	XIX	(9)	75, 101	Y	Y	Y	
		(9a)	217	Y	N	Y	
		(13a)	299	Y	Y	Y	1070
W	XIX	(10)	117, 235*	Y	Y	Y	
		(12)	180, 335	y	Y	Y	
		(12a)	335	Y	N	Y	
		N Pit / N pit top lay	255	Y	N	Y	
		Rim of N. pit	271	Y	N	Y	
	XII	[I]	147	N	N	Y	793
Z	XVIII	(11)+(7)	281	Y	N	Y	
		(11)	168	Y	Y	Y	
		(12)	270, 280	Y	N	Y	
		(13)	148*, 182, 270, 28	Y	Y	Y	35
Total							**8300**

Table 3.4. Pit contexts selected and crosschecked for the present study.

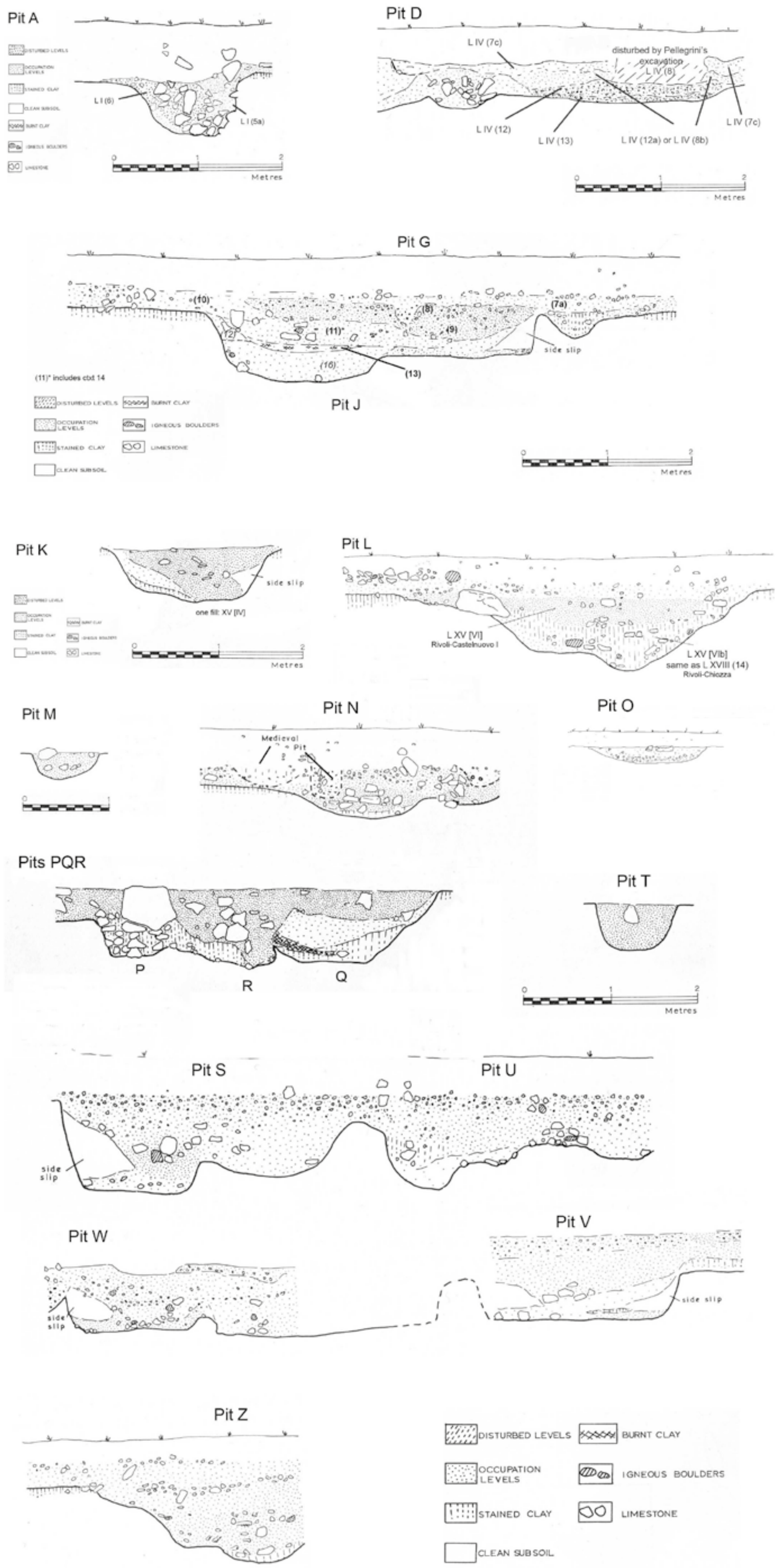


Fig. 3.11. Sections of pits selected for the present study (modified from Barfield & Bagolini 1976, figs. 7-10).

the Rocca di Rivoli excavations and finds retrieved there was to shed light on a still unknown period in northern Italian prehistory. If VBQ pottery in the 1970s was a sort of enigma, even less was known about the flint assemblage belonging to this period. Even now, the assemblage from Rocca di Rivoli remains one of the most abundant and better described ones from the Neolithic of northern Italy. In addition, the Bronze Age flint assemblage is perhaps the only one, in Italy, to have been studied with such care and published in such detail.

Since the 1970s however, as outlined in the previous chapter, a new range of research questions has found its way into prehistoric studies, and directly into the study of flint and stone artefacts. One of the aims of the present research is to see how far finds excavated, bagged, studied and stored away in the 1960s -70s can be used to answer new and different kinds of questions. Fundamental to this end was an assessment of the finds and their potential, as well as a whole series of practicalities which affected the way in which analysis is undertaken.

Sampling

Exact quantification of the contents of 42 boxes of flint artefacts coming from the 1963-1968 excavations was not possible. The material, held in the Prehistory Department of Museo Civico di Storia Naturale in Verona became difficult to access in February 2006. From that point it became clear that because of changes in the museum access policies, it would be necessary to identify and isolate only a sample on which to undertake analysis. Only an approximate estimate of the scale of the assemblage can be put forward here: with each box weighing an average of 5kg, the entire lithic assemblage from 1963-1968 excavations might weigh around 210kg. At the same time, the latter figure does not allow us to differentiate between Neolithic, early and late Bronze Age deposits. An early (2005) inventory of the contents of each box compiled by myself shows that the majority of bags are to be ascribed to Neolithic deposits, but this kind of information remains useless since it does not take into account individual bag size and weight.

The 8300 flint finds analysed for this thesis weighed a total of 44 kg (44.083), or approximately 21% (20.95%) of the hypothetical entire Rocca di Rivoli assemblage. These were selected by taking into account the following criteria:

1. Extent of excavation: fully excavated pits were favoured over partially excavated ones;
2. Occupation phase: all three occupation phases needed to be represented;
3. Degree of conservation: only finds with reliable stratigraphical information were selected as part of the sample (see more below);
4. Disturbance: those pit layers reported to have revealed disturbance by either Bronze Age and Medieval activities were excluded from the sample.

The 44 kg of flint artefacts come from 18 pits: A, D, G, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, Z. The remaining pits (B, C, E, F, H, X, Y, AA, BB, CC) were not taken into consideration in the present study since they were not fully excavated and/or were associated with later disturbance. Pit Z was chosen despite its partial excavation since it contained deposits which are later in date than those contained in pit L. Similarly, although only partially excavated, Pit D was included in the sample since it is one of the three pits ascribed to the later phase of occupation (i.e. Rivoli-Castelnuovo II phase). Contents of pits B and C were either absent or mixed up with other contexts and could not be taken into consideration. Pit H did not produce any flint artefacts.

Whilst re-bagging the finds from their original paper bags into plastic bags, it became apparent that the material had been previously manipulated. There were at least four different styles of handwritings on the paper bags and at least two with permanent markers (blue and black) which started to become available in the 1980s. Handling of the old 1960s paper bags caused wear and tear of the bags and in a number of instances this resulted in breakage of the bags and thus complete loss of context information. Flooding of the museum storage premises sometime between 1975 and 1980 also seems to have affected part of the material, giving some of the contents a peculiar *papier mâché* texture.

In addition, it was soon noticed that there were discrepancies:

1. Among the number of published pit contexts (in Barfield & Bagolini 1976), those listed in the excavation records and those written on labels in and directly on the paper bags;
2. Between labels or writings on bags and marked artefacts contained within them;
3. Between context numbers written on bags and associated pit feature (at least 10 examples where the context number did not match the pit feature).

Prior to definitive closure of the Prehistory section of the Museum in 2007, a selection of lithic archaeological material was isolated on the basis of both 1976 context numbers and writings/labels on actual finds bags. However, when in June 2010 excavation records were obtained, cross-checking of available information was carried out against the latter. Four sets of data were compared:

- The 2006 inventory of material conserved at the Museo Civico di Storia Naturale (compiled by myself on the basis of marked artefacts, labels in and writings on find bags);
- A list of pit contexts as published in 1976 (Barfield & Bagolini 1976);
- A list of contexts documented in the excavation records archive;
- A description of pit contexts and plans/sections present in the excavation records archive.

A set of rules was put in place in order to clarify discrepancies outlined above (Table 3.4). As a result, some of the already collected data were excluded from analysis. Table 3.5 presents the final selection of pit contexts, whereas Figure 3.11 provides a graphic representation of some of the archaeological contexts taken into consideration.

DEGREE OF PRESERVATION	DESCRIPTION	ACTION
Excellent/very good	Artefacts are marked, their marking matches with labels in bag and with writings on bag.	Included in database and analysis.
Good	Artefacts are marked but marking does not match lables in or writings on bag. The latter is intact.	Included in analysis and database, bag changed with matching label and writing.
Fair	Artefacts are not marked but contained in intact bags with matching labels and writings.	Included in analysis and database.
Poor	Artefacts are not marked and contained in worn bags (with holes). Labels and writings match.	All artefacts contained in bag included in analysis and database. Loose artefacts not included.
Very Poor	Artefacts are not marked and are contained in torn bags with no matching label(s) and writings, or artefacts are not marked and contained in worn bags with labels and writings on bags not clear (deletions, different handwritings on top of each other).	Information on context is lost: not included.

Table 3.5. Degree of preservation of Rocca di Rivoli artefacts and associated selection procedure.

Conclusions

The present chapter presented the nature of the archaeological evidence unearthed at Rocca di Rivoli and assessed its validity to answer the research questions set out at the beginning of this work (see chapter 1). As anticipated, the 1960s excavations were carried out with a different research agenda in mind: VBQ pottery was still an obscure phenomenon, which made dating of the evidence and the creation of a pottery typology urgent priorities. One of the goals of the present research is to see how far we can use data retrieved in the 1960s to explore current research concerns such as technological practice, knowledge sharing, organization of production.

Despite the poor conservation conditions that flint artefacts from Rocca di Rivoli were subject to once in museum storage (flooding, handling), we are lucky that the majority of them are available for analysis along with relevant contextual information. Particular care was taken in cross checking information available in order to isolate a reliable sample amounting to 8300 flint artefacts.

There are, however, weaknesses in the available records. The first regards the problematic radiocarbon dates coming from the site (for a full discussion see Appendix 1) which do not help in clarifying further the limited understanding of the stratigraphic relationships among Neolithic features at the site. In particular the relationship between the earliest occupation phase Rivoli-Chiozza (VBQII) and the following Rivoli-Castelnuovo (VBQIII) phase would have been of interest in relation to the still poorly understood dynamics of these two distinct material culture groups which seemed to coexist in certain areas.

The second weakness is that, flint artefacts from the VBQII phase comprise too small a sample for providing statistically relevant information. The site of Rocca di Rivoli is therefore not suitable for a diachronic study, at least as concerns the flint artefacts. The focus of the analysis thus rests on the late Neolithic evidence (VBQIII). Lastly, a peculiarity of the assemblage under study is that it comes exclusively from secondary deposition, i.e. pit fills. The scenario that comes to mind is one in which the ground is periodically cleared of the artefacts (debitage but also beautiful arrowheads and blades alike, as well as other type of material such as pottery or quern stones) to fill a previously dug pit. This process seems to have happened several times (29 pits) at different intervals, although it is difficult to tell when this clearance took place during the knapping process. Presumably it took place at the end of one or more knapping sequence(s), when the core was no longer usable and after suitable flakes for retouch or ready to use had already been put aside. However, the fact that pits received also beautifully retouched tools and artefacts that could potentially still be used or further modified (such as *foliati* and intact blades) leaves space for alternative interpretations of the nature and significance of pit filling which will be further explored following the results of the analysis in Chapter 9.

Preliminary analysis of a few pit contents revealed the striking absence of refits. In some cases it was possible to group artefacts as possibly coming from the same core, but mostly it appeared immediately clear that a number of knapping events were involved and that some were represented only by a few flakes or an isolated core. It is possible to assume that each pit received flint produced by several knappers working at roughly the same time, and interacting one another as well as with other members of the community. The identification of *chaînes opératoires* at Rocca di Rivoli will not isolate individual knappers but rather discern trends within the bulk of artefacts in relation to different styles and attitudes to knapping.

Chapter 4

THE *CHAÎNE OPÉRATOIRE*: FROM THEORY TO METHODOLOGY

Introduction

This chapter explains the concept of the *chaîne opératoire* as an analytical tool, useful for detailing knapped lithic artefacts life-histories. Each stage of material transformation (from raw material procurement to final discard through production, use, reuse, rejuvenation or repair) leaves a series of traces on the artefact generated by human actions that can be 'read' by the analyst and be ascribed, with varying degrees of confidence, to decisions taken during the materials manipulation. The following pages outline and discuss criteria adopted as part of the present methodology, and argue through the specific choices of attributes made here. They illustrate the principles behind the design of a database for collecting information on flint artefacts and in so doing set the scene for artefact analysis which will be used to identify and describe decision making processes during flint knapping at Rocca di Rivoli.

As argued in the previous chapter, material stages of manufacture and use embody social practices undertaken and conducted by individual agents, situated in and an active part of a wider social context made up of people, rules, principles, symbols and beliefs. With this in mind, the employment of the *chaîne opératoire* methodology is intended to put archaeologists in a position to move beyond the description of artefact typology and function (Geneste 1988, 1991; Schlanger 1996). By placing each artefact in a technical context, it is possible to infer the use prehistoric people made of material culture and how this was influenced by cultural choices, situational constraints, raw material accessibility, and so forth.

In the present work, analysis of lithic artefacts focussed on the recording of those physical attributes (quantitative and qualitative) which, according to leading scholars in this field (e.g. Pelegrin 1995; Perlès 1992; Perrin 2001) and taking account of personal replication exercises, have the potential to convey information about knapping skills (e.g. precision of blow, presence of mistakes, use of retouch techniques), technological organization (e.g. which raw material was brought to site and how) and artefact variability at both *debitage* and retouched artefact levels. Sample size (8300 artefacts) and replicability were also taken into consideration in the choice of recordable attributes.

In addition, circumstances related to the accessibility of the Rocca di Rivoli lithic material as well as equipment and related training, affected the choice of data collection methods adopted by the present study, which concentrated on raw material sourcing and sampling, and macroscopic observation of flint artefacts, in order to identify and record technological attributes.

Artefact classes

Four main artefact categories were identified for analytical purposes:

1. Cores
   a) Core
   b) Pre-core
   c) Flake core
2. Debitage
   a) Flakes
   b) Blades
3. Debris
   a) Chips
   b) Chunks
   c) Chunks larger than 3cm
   d) Core shatters
4. Retouched artefacts
   a) Flakes
   b) Blades

Each artefact category encompasses two or more sub-categories that are recognisable thanks to a set of exclusive criteria. Attributes common to all artefact categories combined with category-specific ones convey pieces of information, the comparison or combination of which enables reconstruction of the gestures of Neolithic knappers even when the entire *chaîne opératoire* is not present. The following sub-sections define and describe each artefact category and related sub-categories.

Cores

A core is a block of raw material from which flakes, blades or bladelets have been removed in order to be used as implements or to be further modified to become tools. It is important to distinguish between cores and pre-cores, the latter is a block of flint which has only been tested or from which some material has been removed to convey a determined shape for subsequent knapping. Systematic identification and count of pre-cores and cores at a site might supply information about raw material exploitation organisation. Flake cores consist of large and often thick flakes detached from a core, which are subsequently used as cores themselves in order to provide further debitage.

Debitage

The French word debitage is referred to by Tixier (1963: 32) as "the intentional action of knapping raw material in order to obtain the desired products" as well as "all the lithic pieces produced as by-products in the course of knapping, thus including cores, flakes, blades, chips and so on, but excluding tools (i.e. retouched artefacts) as desired final products". In contrast, literature concerning lithic analysis in the English language, probably influenced by the definition proposed by Crabtree (1972: 58), defines debitage as a "detached piece that is discarded during the reduction process" (Andrefsky 2000: xi), including therefore all the by-products of knapping except for tools and cores.

The use of the term debitage in the present study refers to flint pieces resulting from deliberate knapping, with the exclusion of cores and of pieces displaying intentional retouch on either faces or along their edges (also known as formal tools, see p. 80-81 for further discussion). A further subdivision of the debitage category is conventionally put into place for analytic purposes: flakes, blades and debris.

'Flake' is the general term for a fragment removed from a rock blank, being it core, pebble, slab or tool (Inizan *et al.* 1999: 151-152). Blades were initially defined by Bordes (1961) for the lower and middle Palaeolithic as flakes whose length is equal to, or greater than, twice their width. However, further refinement of the definition was undertaken by Bordes and Crabtree (1969: 1), who describe a blade as "a specialized elongated flake with parallel to sub-parallel lateral edges; transversal section is either plano-convex, triangular, rectangular, often trapezoidal, and on the dorsal surface, one or more longitudinal ridges and two or more flake scars originating from the same direction as blade detachment".

As regards standard measures displayed by blades, these might be expected to vary in every assemblage. For instance, Tixier (1963: 8) studying assemblages in the Maghreb region, defined blades as all artefacts presenting the following characteristics:

a) length equal to or greater than twice the width;
b) length equal to or greater than 5 cm;
c) width equal to or greater than 1.2 cm.

In contrast, bladelets were considered all those artefacts presenting the following characteristics:

a) length equal or greater than twice the width;
b) width less than 1.2 cm.

In a similar way, Bagolini (1968: 199), starting from Tixier's criteria, undertook a comparative study of Italian prehistoric sites (from the Palaeolithic to the Neolithic) and identified eight different categories of flakes and blades on the basis of their length/width ration (see Table 4.3.

above). Such categories were also employed at Rocca di Rivoli for the typometric analysis of complete debitage pieces (Barfield & Bagolini 1976: 75-126) and will be taken into consideration in the present study.

A distinction is often made between true blades and blade-like-flakes. The latter are elongated flakes which display characters traditionally associated with blades (e.g. preparation of platform) since they are usually detached from a blade core, retaining some of its attributes (roughly parallel edges and dorsal morphology characterised by truncated blade negatives (Bordes 1961: 6). Although the distinction is perfectly valid in theory, it is often difficult to make it in practice. Moreover, this type of debitage has often been identified as a tool blank in the Italian Neolithic (the so-called "*schegge laminari*"). No *a priori* category in the present study was differentiated as regards blade-like-flakes. At the same time, blade attributes on flakes were systematically recorded when present.

Debris

Bordes (1947) defined debris as shapeless fragments whose mode of fracture cannot be identified, and which cannot be assigned to any category of objects. Some authors (e.g. Crabtree 1972: 58; Mortensen 1970: 20) distinguish between chips, which are less than 15mm in length and chunks, which are more than 15mm in length and also include fragments of cores or raw material that could not be classified otherwise. For analytical purposes these two categories have been kept separate here. In addition, since a substantial part of the Rivoli assemblage is represented by debris, another two categories were added: "chunks larger than 3cm" and "core shatters". The latter, in particular, might indicate mistakes during knapping or during selection of faulty raw material.

Retouched artefacts

Archaeologists generally distinguish between retouched and non-retouched artefacts. The former are usually equated with formalised tools (Andrefsky 1994; Binford 1979) on which conventional typologies are based (e.g. Laplace 1964). A tool is an artefact which has been utilized for one or more tasks. Formalised tools go through a sequence of production stages which shapes and transforms a debitage piece by means of further removal of small flakes (retouch) from artefact edges and, in some more elaborate examples, from one or both faces of the artefact (flat pressure retouch). They are associated with concepts of standardization, function, tradition, curation, skill, and at times with aesthetics.

With the advance of use-wear analysis the concept of tool has widened to include flakes or implements that have been utilized without further modification (e.g. Audouze 1988; Fullagar 1989; Longo *et al.* 2004). Unretouched tools have often been called "informal tools" and their production has been defined "expedient". Chapter 2 discussed the shortcomings of the binary opposition between the concepts of curation and expediency, and how these have prevented the understanding of technological practice in which both processes coexist. Throughout this thesis I prefer therefore to stick to the term retouched artefact, rather than tool; in particular in the absence of use-wear analysis which could throw light on whether debitage pieces from Rocca di Rivoli were indeed systematically used for a variety of tasks.

Fragmentation

Before exploring the different transformational stages of the *chaîne opératoire* approach, a distinction should be drawn between complete and fragmented artefacts (Table 4.1). Fragmented artefacts are often not taken into consideration by lithic analysts because they fail to supply certain types of data (such as length, width etc.) essential to a number of traditional analyses (e.g. typological and typometrical analyses). However, fragmentation itself, combined with other recorded variables, might point at tool manufacturing methods and techniques (e.g. burin on fracture), or to differential survival of different artefact types (e.g. blades are known to break more easily) in relation to depositional practices and post-depositional factors. Recently, fragmentation has also received attention as a means to signal enchainment practices (as defined by Chapman 2000a; see also Chapman & Gaydarska 2007), despite the fact that knapped lithic examples have been rather difficult to come by (e.g. Chapman 2000a: 22).

Breakage can occur at any stage of the *chaîne opératoire*. A distinction is drawn between whole and fragmented cores: these might break during preparation or initial flaking, after heat treatment or as a consequence of having been used as hammerstones, etc. The difference between a fragmented core and a core shatter (the latter is recorded within the debris category) rests on the type of information that can be retrieved from the two types of archaeological artefacts. In the first case, core features such as striking platform(s), debitage surface(s), removals etc. are still discernible; in the latter case only part of a striking platform with debitage surface might be available. Debris, by definition, consists of fragments. Therefore whereas no fragmentation category other than “fragmented” is available for debris, cores have been recorded as being either fragmented or complete.

Fragmentation of debitage pieces and retouched tools was recorded in more detail (Table 4.1) on the basis of three “interpretation-free” (*sensu* Rozen & Sullivan 1989: 179), mutually exclusive, variables taken from Sullivan & Rozen (1985):

1. SIS, i.e. Single Interior Surface;
2. PAF, i.e. Point of Applied Force: which is “where the bulb of percussion intersects the striking platform” (Sullivan & Rozen 1985: 785);

3. Margins, i.e. in the present study these are distal and proximal ends only.

By checking each artefact against the three variables, it is immediately clear that only complete flakes will present positive values for all three attributes (Fig. 4.1). Broken flakes will usually lack intact margins, but might have preserved butts and it might still be possible to recognise therefore their PAF and SIS and classify them as broken flakes. When neither margins, nor PAF are discernible, the analyst is faced with an unrecognisable fragment which might however still show the pressure ripples/waves. When none of the three of the diagnostic features are discernable the flint piece is classified as debris.

ID FRAGMENTATION	FRAGMENTATION	DESCRIPTION
0	Complete	Whole artefact. Edges might be damaged but overall entire artefact is present.
1	Distal fragment	Fragmented artefact where only distal end is present (blades, flakes and tools only)
2	Proximal fragment	Fragmented artefact where proximal part with PAF (Point of Applied Force) has survived but no distal end (blades, flakes and tools only)
3	Fragment	No proximal (PAF) or distal parts are present, however, ventral ripples and dorsal scars are present.

Table 4.1. Nominal scale and corresponding categories for recording fragmented debitage and retouched artefacts.

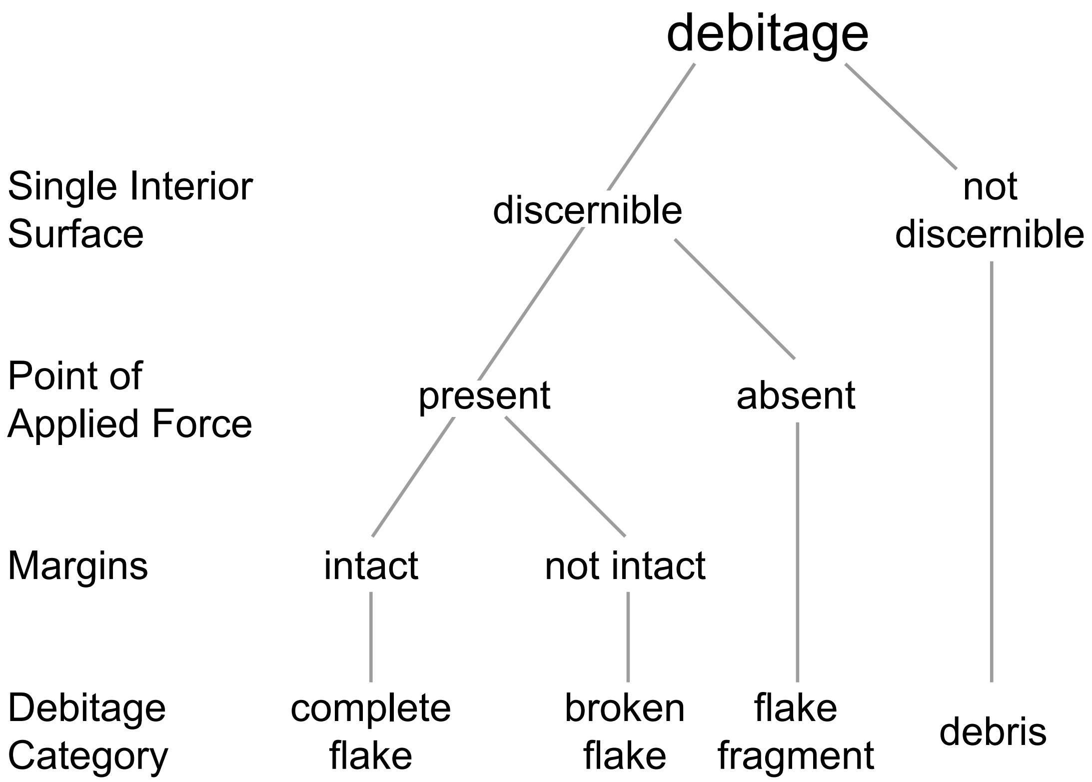


Fig. 4.1. Technological attribute key employed to define debitage classes for the present study (from Sullivan & Rozen 1985, Fig. 2).

Recording of flake, blade and retouched tools fragments can still supply information in order to investigate:

1. The relationship between raw material variety and knapping technology.
2. Blade technology on the basis of modes of core platform preparation, which can also be understood through butt morphology evident on proximal blade fragments.
3. Blade technology in terms of distal end standardization.
4. Knapping accidents.
5. Knapping method/technique in relation to breakage patterns.

Chaîne opératoire transformational stages

Lithic manufacture is fundamentally a reductive technology. The flintknapper shapes the raw material by removing parts of it. In particular, he/she does this by striking the core or flake at a particular angle and location, producing a conchoidal fracture. The latter causes a shock wave that radiates through the material from the point of impact in a conical fashion. It is the traces left by knapping on the flint piece which convey important information about decisions taken by the knapper, e.g. on the type of hammer used, on the raw material selected, on the type of tools produced or on the kind of mistakes made.

Flint flaking is not an innate ability, but one which is acquired through observation, imitation and guided practice. As such, it is deeply rooted in aspects of cultural behaviour, in which 'tradition' plays an important part. Every transformational stage sees a variety of techniques employed, which in turn leave unique marks on the artefacts produced. Several knapping methods were identified and defined by Tixier (1967), who along with Bordes (1947, 1961), Crabtree (e.g. 1972) and Semenov (1964) proceeded to replicate prehistoric knapping activity to find out how prehistoric knappers went about producing stone tools. Controlled replication studies have been instrumental in structuring analytical procedures on one hand, and in recognising and defining flint knapping variables on the other. In prehistoric times, as much as today, knapping presupposes an understanding of:

a) Knapping technique(s) (firstly defined by Tixier 1967: 807); i.e. the way in which a fragment is detached from a piece of rock, by means of a tool suitable for striking and a series of calculated actions performed by the body.
b) Raw material; i.e. its suitability for knapping and its overall quality. Pelegrin (1995: 19) argues that understanding this aspect implies knowledge of suitable raw material sources. However, this does not necessarily mean that the knapper is also the procurer (as it is too often assumed). Therefore knowledge, when referring to raw material means, *latu sensu*, that the knapper knows which raw material to look out for and how to obtain it, by means of either direct or indirect procurement.

Raw material and knapping techniques are therefore the points of departure for every technological analysis of knapped lithic artefacts, aiming at reconstructing one or more *chaînes opératoires*. Four main analytical *foci* were identified for the present study, based on the main research issues outlined in Chapter 1 and inspired by French studies of later prehistoric lithic assemblages (e.g. Tixier *et al.* 1980; Perlès 1980, 1991).

The first looks into raw material procurement strategies (*sensu* Tixier *et al.* 1980: 18-19), and in particular tries to provide insights into decisions underlying raw material choices and the organization of procurement in terms of access to direct and indirect sources. Differences in raw material types, nodule shape and dimension, quality as well as outcrop location, are often employed in putting forward hypotheses about where the raw material comes from, how far the likely sources are, as well as how and by whom flint is brought to site.

The second analytical focus deals with raw material management (*sensu* Perlès 1980: 37) in relation to knapping techniques and methods employed during core preparation, in particular how raw material characteristics are negotiated during opening strategies. Intimately connecting to and following from this, is the third analytical stage, that of debitage management ("*économié du débitage*" already defined in Tixier *et al.* 1980); this consists of the series of actions undertaken during the process of core reduction and subsequent blank selection and retouching. The main objective of debitage management analysis is to identify specific choices based on criteria such as debitage type and its dimensions (length, width, thickness), shape, core reduction and rejuvenation methods, etc. One or more combination of these variables might be found to occur over and over again at inter- or intra-assemblage level, and points in the direction of the existence of traditions. The combination of raw material data and information on debitage management gives rise to different knapping modalities (Perlès 1991).

Finally, the retouching of debitage pieces also encompasses a variety of techniques and methods (Pelegrin 1995: 20). The way in which retouched tools are used, with or without further modification, with edge rejuvenation or further tool transformation - detectable mostly by means of microscopic observation (e.g. Cahen *et al.* 1980: 216-217), but also through the recognition of rejuvenation byproducts such as burin spalls - gives rise to the notion of "*gestion de l'outillage*", i.e. management of the tool assemblage (*sensu* Binder & Perlès 1990; also Perlès 1992).

When applied to flint artefacts, the *chaîne opératoire* approach treats flint-knapping as a subsystem of a larger technological system (Pelegrin 1995). Different transformational stages can be recognised within a single *chaîne opératoire*, and several *chaînes opératoires* can co-exist within an assemblage. Not all operations necessarily take place at the same site, and they might vary from assemblage to assemblage. Similarly to other works employing the *chaîne* *opératoire* analytical method in the field of later prehistoric lithic studies (e.g. Perlès 1999; Perrin 2001), the present study takes into consideration the following transformational stages:

1. Raw material procurement
2. Initial flaking (including test flaking)
3. Core preparation
4. Core reduction
5. Core maintenance
6. Core abandonment

Each flake detached at any of the above mentioned stages might, potentially, be chosen as a tool blank, and subsequently undergo further transformations in order to be turned into a pre-determined tool type, originating another series of transformational stages:

1. Blank selection
2. Blank roughout
3. Modification (by means of retouch)
4. Retouched artefact use & maintenance (rejuvenation, breakage or repair)
5. Retouched artefact abandonment/deposition

The following sections will outline and discuss the main key issues relevant to each transformational stage with particular attention to the four analytical *foci* outlined above. Attributes selected for each transformational stage are described further on in a separate section in which recording criteria are outlined. The identification of technological attributes (e.g. butt morphology) along with the definition of one or more reciprocally exclusive criteria composing such attributes, was the first step towards the classification of the information/data retrievable by means of macroscopic observation of the lithic artefacts from Rocca di Rivoli. Selection of attributes was influenced by the following factors:

1. Research questions formulated prior to conducting the analysis as well as on the theoretical background embraced by the analyst;
2. Methodology adopted;
3. Replicability of employed criteria;
4. Degree of confidence felt by the analyst in identifying and defining such criteria.

It is difficult to tell *a priori* whether the recording of particular attributes will lead to significant results. Decisions on which criteria to adopt took place after a preliminary assessment, during which the nature of the assemblage was observed and relevant lithic studies literature was reviewed. Attributes were therefore identified both at a general level (i.e. for all artefact types) and for each artefact category.

Raw material procurement strategies

Raw material exploitation has always been held to represent an important economic factor, often affecting settlement choices and production strategies of human communities since early prehistory (e.g. Andrefsky 1994; Torrence 1989). In addition, anthropological and ethnographical research has documented a variety of ways in which raw material procurement is organised in non-industrial societies, highlighting how this activity is often shaped and ruled by concerns that go beyond utilitarian and functional logic (e.g. Elkin 1964; Godelier & Garanger 1973; Gould 1980; Petrequin & Petrequin 1988, *contra* Sillitoe & Hardy 2003). Obtaining the right type of rock for knapping a specific set of tools by means of employing a known flaking method and a series of techniques, was surely of paramount importance, whether it was for the production of flakes ready to use without further modification or for the careful and skilful knapping of finely retouched prestige items.

Analysis of raw material procurement, the first stage of the *chaîne opératoire* analytical method, requires identification of the different kinds of rock types used for artefact production, together with the identification of possible flint outcrops exploited by Neolithic people in the area and beyond. The aim of the first approach is to identify raw material management in relation to technological choices, whereas the second approach seeks to gain insights into the raw material procurement strategies in relation to the surrounding landscape.

There are various techniques to identify the different types of flint through macroscopic and microscopic characterization (for a brief excursus see Andrefsky 1998: 40-44). The former is undertaken with the naked eye and the aid of a 10x lenses in order to better grasp certain characteristics such as colour (including patterning if any), texture, fossil inclusions, type of cortex if present etc. Microscopic approaches are mostly borrowed from geochemistry and tend to focus on the identification of one or more elements in order to assess raw material provenance. For example, petrographic analysis by means of thin section microscopy allows to identify minerals and microscopic fossils that are associated with a specific rock formation.

The flint of the Verona area displays as much variation within a source location as between different source locations. Both macroscopic and microscopic techniques have limitations (Candelato et al. 2003), further complicated by the small dimensions of the artefacts, traces of weathering and the impossibility to manipulate the artefacts to make them suitable for microscopic analysis (e.g. no fresh breaks). A certain degree of error is therefore to be expected and a common measure adopted in the literature to minimize it, is the creation of a lithoteque, a reference collection with specimens of flint types sampled directly from the outcrops in the area. Fieldwork was undertaken as part of the present work and of the S.E.L.C.E. project, which contributed samples to enrich the lithoteque housed in the Natural History Museum in Verona.

No flint outcrops are present on the Rocca di Rivoli itself, but, as discussed in Chapter 5, both primary outcrops and secondary deposits are present in the vicinity of the site, as well as further afield. Despite numerous problems affecting flint characterization methods (at both micro- and macroscopic levels) the identification of different types of raw material remains pivotal to the study of prehistoric flint assemblages.

All artefacts from the Rocca di Rivoli assemblage were attributed, whenever possible, to a raw material category on the basis of data collected during fieldwork and geological information available in the literature (e.g. Bertola 2006; Isotta & Zanini 2008; Longo *et al*. 2004). In addition, in order to take into account the wide range of colours (at both intra- and inter-formational level) typical of the flint in the area, the colour of flakes, blades, tools and cores was recorded using Munsell Colour Chart codes. Other distinctive raw material characteristics were recorded when present, such as the presence of bands, striations, inclusions, the vitreous appearance of the lithotype, and cortex type (Cremaschi 1981; Marshall 2000). Additional information might also be provided by the characteristics of the parent material, such as original dimensions and shape.

ATTRIBUTES	CORES	FLAKES	BLADES	DEBRIS	RETOUCHED
Raw Material	✓	✓	✓	✓	✓
Colour	✓	✓	✓		✓
Colour characteristics	✓	✓	✓		✓
Parent Material (when cortex is present)	✓	✓	✓	*	✓
Parent Material dimensions	✓				
Parent Material shape	✓				

* recorded only when debris was large enough to allow attribution.

Table 4.2. Artefact categories and attributes recorded in relation to raw material procurement strategies.

Test flaking and core preparation

Following the identification of a suitable flint pebble, nodule or block, knappers proceed to test its quality by removing one or two flakes. Ethnographic examples indicate that this procedure often takes place at the flint source (Binford 1986).

In the archaeological record, this transformational stage can be recognised by the presence of pre-cores, i.e. raw material with a few negatives which might be either rejected because not suitable for knapping or preserved for future knapping. Features of test flaking can also be detected on flakes and blades, the 'dorsal' surface of which is entirely corticated. In addition, flakes produced during initial flaking might be expected to show little or no platform preparation. These latter characteristics can, however, be recognised also on debitage associated with the subsequent transformation stage of core preparation. As a matter of fact, knapping of a nodule into a pre-determined core implies the early detachment of fully corticated flakes the platform of which might not have been previously prepared. Therefore test flaking or the intial stage of core preparation cannot be differentiated by observing a fully corticated flake with no platform preparation. In this instance, debitage attributes unambiguously point to the early stage of raw material transformation, but cannot be used to distinguish further between initial flaking and core preparation unless there are refits.

As regards cores, it is usually possible to distinguish pre-cores from cores on the basis of the amount of cortex or natural surface still present and the number of negatives displayed. Through personal replication attempts, one to three removals are in general sufficient to test the quality of the raw material. For the present study it was therefore decided that pre-cores are rocks that display a high percentage of either cortex or natural surface (more than 75% of the total rock surface) and 1 to 3 negatives (scars left by flake removal). At times, there might be doubts about authenticity of scars, since these might resemble naturally occurring ones, especially on sites situated on soils naturally rich in flint nodules or pebbles and disturbed by ploughing. The systematic recognition of pre-cores and cores at a site is therefore significant in terms of supplying information about raw material exploitation organisation. Fortunately, at Rocca di Rivoli there is no naturally occurring outcrop and all flint present there was carried to the site.

Subsequent to testing, core preparation takes place. The effort spent in preparing cores in order to obtain desired types of detached pieces is highly variable. Each method is defined by specific schemes (both conceptual and operative). By taking into consideration the morphology of the core and the desired flake type to detach, the knapper will prepare a striking platform which will be struck time after time, generating a number of debitage pieces.

Preparation of the striking platform can be recognised from both cores and debitage pieces. On a core, the striking platform may undergo preparation prior to striking flakes or blades by means of abrasion with the hammerstone or by a series of removals. Platform preparation features are, however, not always detectable for each reduction stage since most cores reach the analyst after they have been fully exploited. In addition, platform preparation does not always take place. Its necessity is linked on one hand to the type of debitage the knapper wishes to obtain and, on the other, to the shape and dimensions of the raw material.

Observation of debitage butts provides information about whether the core platform was prepared and how. For instance, a butt with cortex (Fig. 4.9, no. 1) points to the fact that no preparation took place, whereas a punctiform butt (Fig. 4.9, no. 10) is the result of great precision and accuracy in platform preparation for the manufacture of fine blades. In addition, little or no preparation or any shaping out of the core, might entail the almost complete absence of characteristic flakes. In contrast, preparation of a blade core aims deliberately and repeatedly to produce flakes whose length is equal to, or greater than, twice their width. For this reason, blade production clearly requires a predetermined operational sequence (Inizan *et al.* 1999: 61). Overall, blades display a more accurate core platform preparation, recognisable on both cores and blade butts (ibid.).

Some core preparation techniques, such as the Levallois method (e.g. Boëda 1994), are better understood than others. Later prehistoric reduction sequences are still poorly understood and the majority of studies in this field point out the absence of a standardised procedure (e.g. Astruc 2005).

ATTRIBUTES	CORES	FLAKES	BLADES	DEBRIS	RETOUCHED
Cortex	✓	✓	✓	*	✓
Platform preparation	✓	✓	✓		✓
Type of core (pre-core/core/flake core)	✓				
Number of negatives on core	✓				
Dorsal morphology		✓	✓		✓
Butt type		✓	✓		✓
Utilization stage (core)/Knapping stage (flakes, blades, tools)	✓	✓	✓		✓

*recorded as absence/presence only.

Table 4.3. Artefact categories and recorded attributes relevant to test flaking and core preparation transformational stages.

Core reduction

Once the core has taken the desired shape, and in particular the striking platform has been prepared to provide the right knapping angle, detachment of debitage pieces takes place, until the knapping angle allows it. The core reduction stage implies the production of desired debitage pieces, which might be subsequently turned into blanks, pre-forms and, finally, tools.

Many authors make a distinction between core reduction and tool manufacturing knapping processes (e.g. Jeter 1980; Klie *et al.* 1982: 219-221), ascribing to either of them determinate types of debitage, identifiable on the basis of a series of distinctive traits, the quantity of cortex present on their dorsal face being the most important of all (e.g. Inizan *et al.* 1999). However, controlled lithic reduction replication studies (e.g. Neumann & Johnson 1979) have pointed out that artefacts produced by a specific reduction sequence do not necessarily exhibit the same combination of attributes, and that these attributes are not expressed to the same degree. Most importantly, both so-called tool and non-tool debitage types are produced during a single reduction episode (Newcomer 1971). For this latter reason and because of the nature of the Rocca di Rivoli assemblage (i.e it includes several reduction sequences for which no refitting exercise could be undertaken), no distinction between tool and non-tool debitage was attempted. Efforts were instead put into defining an analytical model which could characterise debitage coming from different core reduction modalities.

A number of analytical models are available from the lithic studies literature in order to obtain meaningful information from masses of debitage (the most recent by Andrefsky 2001). However, because debitage studies have received attention only very recently (i.e. they are therefore still developing) and have been applied mainly to hunter-gatherer assemblages, some caution should necessarily be used in identifying transferable concepts to be employed in the study of later prehistoric assemblages. In addition, despite the criticism put forward by Sullivan and Rozen in their 1985 paper, few studies have used replicable criteria for their analytical models, and therefore there are no easily comparable data available. Nonetheless, despite the strong regionalism persisting within lithic studies (see Chapter 2), the high variability characterising lithic assemblages and the disparate range of interpretive issues lithic analyses focus upon, there are a series of prehistoric technological behaviours that do receive constant attention by analysts. This is mainly because they have the potential of being at the same time informative of the relationship between human beings and their natural surroundings (type of raw material used, type of hammer employed) and of social relationships between different members of society (e.g. apprentice-expert knapper).

The first regards knapping techniques, including direction, intensity and angle of blow, the type of hammerstone used and bodily gestures. Knapping techniques, which have been described at length (e.g. Bordes 1947, 1961; Tixier *et al.* 1980), have specific attributes which can be observed, with the naked eye, and quantified (Table 4.4).

Technique	Platforms width	Butt morphology	Impact point	Bulb of percussion	Errailure scar
Direct percussion with hard hammer	Thick	Unprepared or prepared through abrasion	Present	Pronounced/ broad	Present
Direct percussion with soft hammer (organic)	Thin	Prepared through abrasion. At times carefully prepared	Absent	Diffuse/flat	Absent
Indirect percussion (with punch): blades & bladelets only	Thin	Accurately prepared	Absent	Pronounced/ small	Absent
Pressure (with punch): blades and bladelets only	Always narrower than the maximum width of the blade	Accurately prepared	Absent	Pronounced/ small	Absent

Table 4.4. Attribute description associated with different types of knapping techniques.

After a quick look at the Table 4.4, however, it is clear that it might be impossible to distinguish between indirect percussion and pressure flaking. Whittaker (1994) describes this latter technique at length. In general, pressure flakes are reported to be overall thinner, smaller and to weigh less than those obtained by means of other methods. A more useful series of discriminating attributes is provided by Inizan and co-workers (Inizan *et al*. 1999: 79), according to whom blades obtained by means of pressure flaking have:

a) A butt always narrower than the maximum width of the blade;
b) Parallel edges and arrises, which tend to be rectilinear;
c) Constant thickness, mesial section included;
d) No obvious ripples on the lower face.

Attributes a) to d) have been extrapolated from observation of Upper Palaeolithic artefacts and experimental work geared towards the replication of Upper Palaeolithic tools. Although flint mechanics do not vary through time, we might expect some variation in relation to the description of the set of attributes listed above, triggered by changes in traditions. In addition, some caution must necessarily be used when interpreting data related to the recording of nominal attributes; for instance, the type of raw material chosen greatly affects the readability of the traces left by knapping techniques (such as the bulb of percussion, the presence of an errailure scar or of an impact point). Most importantly, it is a combination of attributes that might reveal the gestures carried out by middle Neolithic knappers at Rocca di Rivoli.

Reduction methods are also indicated by overall shape of the core, defined by the number of striking platforms together with type, number and direction of negatives. For instance, one-platform, one-direction blade or bladelet core resembling a pyramid (pyramidal cores or pseudo-pyramidal), allows for the flaking of blades or bladelets with a curving profile; whereas two-platform, multidirectional flake cores might take a globular shape as irregular flakes are taken off through the exploitation of *ad hoc* striking platforms.

In the production of blades (or bladelets) certain rules, which have been confirmed by replication studies, need to be observed, such as:

a) Ensuring an adequate morphology of the edge of the striking platform for blades by means of various technical procedures (e.g. overhang removal, abrasion, isolation of striking platform) which are often signatures of cultural traditions (Inizan *et al.* 1999: 74);
b) Maintaining, after each blade removed, both an adequate core morphology and relatively parallel arrises to allow for further blades to be detached (also known as *cintrage* and *carénage* respectively) (ibid.);
c) Control of direction and applied force of blow in order to avoid distal end mistakes (such as hinged or plunged blade terminations) which would hinder further blade production (ibid.).

The type of hammer employed also reflects the degree of platform preparation. Elaborate preparations (e.g. isolation of the area to be struck, removal of small overhangs) are associated with the use of a soft hammer and a one-platform pyramidal cores have often been associated with the production of blades and bladelets.

Core analysis, however, ‘registers’ the reduction process at a specific moment in time: it is only rarely possible, thanks to refitting, to know what went on prior to the core becoming completely spent, or fractured, or before tiny flakes were removed in the last stage before abandonment.

Again, a combination of core and debitage attributes might help to “mentally refit” (after Pelegrin 1995: 23) the different actions which took place as part of one or more *chaînes opératoires*. Core attributes are therefore compared and combined with those of debitage, tools and debris. For instance, flaking direction, which on the core is detectable through observation of the directions of negatives, might also be inferred by observation of dorsal scar directions on debitage and tools.

Dorsal flake scar sequences also hold potential information of core reduction techniques. However, these have not received much attention from lithic analysts since it is undoubtedly more difficult to identify these confidently. According to Dauvois (1976) and Ohnuma (1988), the order of each flake scar is manifested in features like fissures, percussion ripples and tiny lips overlapping the subsequent scar, and it can be recognised through refitting exercises or experimental studies. Dorsal negative count was not recorded; although some authors report it to be a useful indicator of the stage of production (e.g. Kooyman 2000), because it is extremely time-consuming and it was deemed more relevant to record attributes relating to butt morphology in addition to specific flake types (renamed as “knapping stage”) and the presence of knapping accidents.

As regards striking platforms, there are different ways to measure and analyse them. Variability displayed by this attribute has been used to infer the type of hammer used (see above Table 4.8; e.g. Cotterel & Kamminga 1987; Hayden & Hutchings 1989), the type of core being knapped (e.g. Magne & Pokotylo 1981) and transformation stages of biface production (Dibble & Whittaker 1989; Johnson 1989). Magne and Pokotylo (1981) showed how butt width correlates with the size of debitage, and Odell (1989: 185) argued how both striking platform width and thickness are valid attributes to distinguish reduction sequences.

Finally, the exterior striking platform angle has been used to determine bifacial reduction sequences (Raab *et al*. 1979). Generally speaking, greater application loads are required to detach a flake with the exterior angle approaching 90° (Dibble 1997: 157; Whittaker 1994: 109), whereas low, < 90°, exterior angles tend to be associated with soft hammer percussion (Clark

& Kleindienst 1974: 87-88). In addition, Speth (1981) pointed out that the ability to detach a flake from a particular core platform is also affected by the location of impact (i.e. the flake's intended platform thickness), and that as the angle between core striking platform and debitage surface increases, there is a decrease in the area of the platform edge from which a flake can successfully be struck. He concluded that the larger the angle, the greater the accuracy required to detach a flake. Some authors (e.g. Dibble 1997: 157; Dibble & Pelcin 1995; Speth 1981) further argue that a flake with a low exterior platform angle can be struck from a greater range of striking angles than a flake with high exterior platform angles.

From the experimental knapper's point of view, the exterior platform angle not only helps to determine whether or not a flake can successfully be detached, but it also affects the condition of several flake attributes, such as:

1. Termination (Dibble & Whittaker 1981: 287; Whittaker 1994: 109; Pelcin 1997b: 1107);
2. Presence of ring crack (Pelcin 1997a: 620);
3. Interior platform angle (Dibble & Whittaker 1981: 287; Pelcin 1997a, 1997b).

Through experimental replication studies, Dibble and Whittaker (1981: 284-287) argue that production factors such as angle blow, impact force and platform thickness do not significantly affect the interior platform angle. The relationship between the exterior platform angle and the above mentioned attributes, however, is far from straightforward due to a series of factors discussed at length by Pelcin (1997a, 1997b).

Striking platform attributes remain crucial in the analysis of lithic debitage and they figure widely in lithic studies. At the same time, Andrefsky (1998: 89-91) notes the difficulty of replicating platform angles measurements, due to the nature of flake and blade butts (small dimensions, uneven surface, presence of lips etc.). For the purpose of this study a nominal scale was chosen, with exterior platform angles being attributed, by eye, to three mutually exclusive categories: < 90°, > 90°, 90°. The latter is perhaps the most difficult to ascribe easily, but with the help of a right angle it can be confidently identified.

The identification of specific types of flakes is also useful in determining the type of reduction sequence. Some lithic researchers employ a typological approach to debitage analysis because they feel that the recording of attributes is time-consuming and attribute definitions are too subjective (e.g. Ahler 1989; Sullivan & Rozen 1985). With a typological approach, debitage is subdivided into different categories or classes on the basis of a set of characteristics defined in advance by the analyst. Debitage typologies have been used to distinguish specific knapping techniques (e.g. hard/soft hammer) (Crabtree 1972; Hayden & Hutchings 1989), and the stage of reduction sequence (Mauldin & Amick 1989), to infer the presence of specific artefacts or knapping techniques on site (Andrefsky 1998; Raab *et al.* 1979). The approach employed here makes use of a restricted number of debitage types which are widely employed in lithic studies in Europe and US (see below).

Other distinctive flake types are those associated with knapper's mistakes. These too are identifiable through the presence of specific traits on flakes terminations, platforms and dorsal surfaces (see Fig. 4.15 and Table 4.20). The identification of knapping accidents is of vital importance since it enables the archaeologist to distinguish between intentional and unintentional knapping and the *chaîne opératoire* brought into play. In addition, accidents help the analyst in assessing the knappers' degree of competence, pinpointing faults in the raw material. Finally, when apparent accidents are repeatedly linked to specific techniques (such as the rejuvenation of a core by means of detaching a plunging flake), these might be intentional and provide insights into knapping traditions.

ATTRIBUTES	CORE	DEBITAGE		RETOUCHED	DEBRIS
		FLAKES	BLADES		
Cortex	✓	✓	✓	✓	✓
Cortex position	✓	✓	✓	✓	
Removals type	✓				
Debitage direction (core) & Dorsal morphology	✓	✓	✓	✓	
Striking platform area/ Striking platform count	✓	✓	✓	✓	
Length/width/maximum thickness	✓	✓	✓	✓	
Platform thickness		✓	✓	✓	
Impact point		✓	✓	✓	
Eraillure scar		✓	✓	✓	
Bulb of percussion		✓	✓	✓	
Butt type		✓	✓	✓	
Platform angle		✓	✓	✓	
Dorsal morphology		✓	✓	✓	
Knapping stage		✓	✓	✓	
Knapping accidents	✓	✓	✓	✓	
Parallel sides		*	✓	•	
Distal shape		*	✓	•	
Profile		*	✓	•	
Transverse section		*	✓	•	
Platform preparation		*	✓	•	

*attributes recorded only when felt informative (e.g. flake detached from blade core).
•attributes recorded systematically for retouched blades, as above for the rest.

Table 4.5. Attribute categories supplying information on core reduction and maintenance transformation stages.

Core maintenance

During flaking the core often receives maintenance either to recover from knapping accidents or to renew exhausted platforms and flaking surfaces. Maintenance activities are reflected on cores themselves and produce characteristic debitage classes (e.g. platform tablets). One way to optimize core exploitation is through changing flaking orientation. On rotated cores, flake scars with a single directionality are found truncated by those with another directionality. Upon closer examination of scar patterns on cores of this type, it might be possible to recognise different methods of change of orientation.

Attributes of core maintenance techniques are the same of those used for recording attributes relating to core reduction stages (Table 4.5). The difference rests on the recording of the type of flake relating to core maintenance, rather than just an ordinary flake. The presence of knapping accidents on cores, as well as on both retouched and unretouched artefacts, might point to correction efforts by the knapper in order to continue knapping the desired product.

Core abandonment

Cores are abandoned at different stages of reduction. Reasons for their discard cannot be confidently identified in most cases. Apart from intentional interruption, irreversible knapping accidents and exhaustion are two recognisable causes.

An irreversible knapping accident observable on cores is platform crushing; when a core platform displays a series of small fractures on the main flaking surface along the platform edge. These fractures are often hinged or stepped, suggesting that they were caused by miscalculation by the knapper.

Size reduction is probably the major cause for core abandonment. An approximate idea of how intensively a core was exploited can be obtained by comparing size of cores with that of debitage and tool blanks (Nishiaki 2000).

ATTRIBUTES	CORE	DEBITAGE		RETOUCHED	DEBRIS
		FLAKE	BLADE		
Cortex/Cortex position	✓				
Utilization stage	✓				
Core abandonment	✓				
Striking platform area / number	✓				
Max width last removal	✓				
Max length last removal	✓				
Knapping accidents	✓				

Table 4.6. Attributes conveying data on core abandonment transformation stage.

Retouched artefacts

The term "retouch" describes removals by percussion or pressure with the intention of making, finishing or sharpening artefacts (Inizan *et al*. 1999: 81). The extent and accuracy of retouch on artefacts can vary considerably within the same lithic assemblage. Factors such as the degree of skill of the flintknapper, functional aspects of the end product, raw material quality variability or differing perceptions and values associated with the manufacturing of different types of flint tools, all contribute to the variability of retouched artefacts.

It is precisely this variability which has especially interested prehistorians. Retouched artefacts, the final products of the work of flintknappers, have often been employed as "fossil guides" to date assemblages. For example, for a long time, the middle Neolithic of northern Italy was associated to the so-called "*foliati*", artefacts with flat retouching applied by pressure on debitage edges and at times partially or entirely covering both faces. Traditionally, it is retouched artefacts which are compared at inter-assemblage level in order to infer the type of site being investigated (e.g. quarry, workshop, etc.) and the kind of activities being carried out at the site (e.g. sickle blades=harvesting; arrowheads=warfare or hunting, and so on).

At the same time, the validity of traditional typologies has been questioned by advances in use-wear analysis, which has revealed discrepancies in retouched tool morphology and assumed function: a tool might be used in a variety of ways and on a variety of materials. Subsequent to such discoveries typologies have been put forward, especially as part of the French lithic studies tradition, which take into consideration technology together with use-wear analysis. The need to support a traditional typological analysis with both technological and microscopic approach has also found its way into Italian later prehistoric studies (Conati Barbaro *et al*. 2002).

ATTRIBUTES	CORE	DEBITAGE		RETOUCHED	DEBRIS
		FLAKES	BLADES		
Position				✓	
Localization				✓	
Distribution				✓	
Delineation				✓	
Regularity				✓	
Angle				✓	
Extent				✓	
Morphology				✓	
Special techniques				✓	
Knapping stage				✓	
Accidents				✓	

Table 4.7. Attributes supplying information for roughout and final modification stages.

Because of the macroscopic approach adopted here, investigation into retouch techniques has been limited to the recording of attributes recognisable with the naked eye (Table 4.7), focussing on technological behaviour marked by patterns and associations between blank types and the frequency of retouch modalities.

Blank selection

A blank was defined by Bradley (1975: 5) as: "any piece of lithic material that has been modified to an intended stage of a lithic reduction sequence in a specified assemblage. It must be demonstrable that it is not a finished implement and that it is intended for further modification. Furthermore it must have the morphological potential to be modified into more than one implement type within the assemblage". Blank selection criteria may be revealed by comparison between morphological features including size of tools (selected pieces) and debitage (rejected pieces), as well as by comparing tool and debitage raw material type. Selected blanks may be subsequently truncated or broken to produce a roughout for further intensive retouch.

ATTRIBUTES	CORE	DEBITAGE		RETOUCHED	DEBRIS
		FLAKES	BLADES		
Cortex & Cortex position		✓	✓	✓	
Weight		✓	✓	✓	
Length, width, maximum thickness		✓	✓	✓	
Platform thickness		✓	✓	✓	
Impact point		✓	✓	✓	
Errailure scar		✓	✓	✓	
Bulb of percussion		✓	✓	✓	
Butt type		✓	✓	✓	
Platfrom angle		✓	✓	✓	
Dorsal morphology		✓	✓	✓	
Knapping stage		✓	✓	✓	
Knapping accidents		✓	✓	✓	
Parallel sides		_	✓	•	
Distal shape		*	✓	•	
Profile		*	✓	•	
Trasversal section		*	✓	•	
Platform preparation		*	✓	•	

*attributes recorded only when considered informative and/or discriminating (e.g. flake detached from blade core).
•attributes recorded systematically for retouched blades.

Table 4.8. Attributes supplying information on blank selection transformation stage.

Rough-out and final modification

Retouching modifies a blank and can derive from actions intended to turn the blank into a pre-form or roughout. I will use these two terms synonymously, although they are at times kept separate with a roughout representing the knapping stage prior to the preform (Butler 2005: 207-208). A roughout is an almost finalised tool: it has the shape of the end-product, although it clearly shows that further retouching is needed in order to complete the tool (in terms of dimensions, thickness and edges morphology). In the case of Rocca di Rivoli, this category is employed to describe the last stages of the production of bifacial flatly retouched tools (e.g. arrowheads, points etc.).

Artefact use and maintenance

Use-wear analysis along with controlled experimental replication (e.g. Keeley 1980; Semenov 1964) has greatly enhanced what we know about how tools were utilized and manipulated. Understanding of tool hafting and prehension (e.g. Beyries 1988; Keeley 1982), subsistence (e.g. Anderson-Gerfaud 1983; Juel Jensen 1989), specialization and symbolism (Odell 1994; Yerkes 1983), have benefited hugely from both low and high power microscopic study. Perhaps the most important contribution of use-wear analysis has been the discovery that any artefact could be used in a variety of ways and on very different materials. Traditionally, archaeological artefact types are grouped into typological lists on the basis of a presumed function, which is inferred in turn by morphological characteristics. In addition, each type is generally associated with one function (e.g. scraper=hide working; arrow point=weapon). Microscopic analyses, however, have shown that most tools are versatile and can be put to a number of tasks, making tool morphology less relevant to tool function, contrary to what was once believed (Audouze 1988).

One of the effects of use and manipulation is that the tool's original morphology is likely to undergo a series of changes during its use-life. Certain tools might be re-used or re-sharpened after a period of utilization. This behaviour is difficult to recognise without the aid of refitting (Frison 1968) or use-wear analysis (Cahen *et al.* 1979). Nonetheless, the presence of certain types of debitage by-products, such as burin spalls, point to episodes of tool maintenance and rejuvenation that can be detected without the use of microscopy.

Artefact discard

Discard is the last stage of the *chaîne opératoire*; i.e. when the lithic artefact is no longer used and enters the archaeological record. Discard processes are varied, and their identification and understanding are both linked to and dependant upon the significance attributed to refuse. At Rocca di Rivoli, flint artefacts were found abandoned on the ground and in the fill of 28 out of 29 pits (Barfield & Bagolini 1976). Artefact fragmentation and edge condition have been held to be indicators of weathering and post-depositional effects (such as trampling) and might indicate differences in attitudes to artefacts disposal. At the same time, fragmentation can also be caused by accidental breakage during knapping or during utilization.

ATTRIBUTES	CORE	DEBITAGE		RETOUCHED	DEBRIS
		FLAKES	BLADES		
Fragmentation	✓	✓	✓	✓	✓
Edge Condition	✓	✓	✓	✓	✓
Accidents	✓	✓	✓	✓	

Table 4.9. Attributes supplying information on artefact use, maintenance and discard.

Recording technological information

The identification of technological attributes, along with their definition, was the first step towards the classification of the information retrievable by means of macroscopic observation of the lithic artefacts from Rocca di Rivoli. Selection of attributes was influenced by the following factors:

1. Research questions formulated prior to conducting the analysis, influenced by the theoretical approach adopted.
2. Methodology adopted.
3. Replicability of employed criteria.
4. Degree of confidence felt by the analyst in identifying and defining such criteria.

During a preliminary assessment it was decided that a mixture of aggregate attribute analysis and typological analysis would be employed. The first examines the distribution of an attribute (e.g. amount of cortex on dorsal surface) over an entire population or assemblage. The latter deals with individual debitage categories (e.g. fully corticated flakes) (Andrefsky 2001: 6-12) where individual artefacts are classified into types displaying a number of specific attributes that, taken together, have a specific technological meaning. For example, a bifacial thinning flake is characterised by a faceted and narrow platform and intersecting scars on the dorsal side in addition to a slightly curved profile. The recording of specific types of debitage allows for the identification of distinctive *chaînes opératoires* or stages within specific *chaînes opératoires*. In addition, because lithic assemblages belonging to the late Italian Neolithic are poorly understood, the recording of debitage attributes is undertaken in order to characterise assemblage types from this period from the technological point of view, at both intra- and inter-assemblage levels. In this way, these two types of analysis complement each other.

Data collected was of two kinds: qualitative and quantitative. The latter refers to measurements, weight and counts (e.g. number of core striking platforms or debitage length); the former relies on the analyst's observation, and therefore on his/her degree of understanding of flint knapping processes. Regardless of their quantitative or qualitative nature, it is important that both attributes and data collection *modus operandi* are well-defined, in order to limit errors and ambiguity and, most importantly, to allow for replicability and comparison with other sets of data.

As anticipated above, when defining artefact categories, there are attributes which are relevant to all artefact classes, such as the type of raw material they belong to or stratigraphical information. Other types of attributes specifically refer to one class of artefacts and are therefore category-specific ones. The following sections below will look in detail at both these attribute classes.

<table>
<tr><th rowspan="2">CORE</th><th colspan="2">DEBITAGE</th><th rowspan="2">RETOUCHED</th><th rowspan="2">DEBRIS</th></tr>
<tr><th>FLAKES</th><th>BLADES</th></tr>
<tr><td colspan="5">Cortex
Cortex Position
Parent material
Raw material
Edge condition
Fragmentation
Thermal modification
Weight
Colour
Colour characteristics</td></tr>
<tr><td colspan="5">--- Excavation records ---
Site name
Excavation year
Zone
Area
Context
Feature
Bag no.
Photo no.
Drawing no.
ICCD no.</td></tr>
</table>

Table 4.10. General attributes recorded for all artefact types coming from Rocca di Rivoli 1963-1968 excavations.

General attributes

For each of the above-mentioned categories and subcategories, attributes were selected which correspond to the main fields in the Rocca di Rivoli artefacts database. Four different kinds of attribute scales are employed to collect data from examined artefacts:

a) Nominal: in which all states of attribute are mutually exclusive and exhaustive (e.g. raw material type, artefact type) (Andrefsky 1998: 63);
b) Ordinal: in which measurements are only possible when measuring variables that occur along some continuum (e.g. platform angle; platform preparation, extent of retouch) (Van Pool & Leonard 2011: 8-9);
c) Interval: in which measurements are taken along a continuum which is partitioned symmetrically into even increments but with an arbitrary zero value (Van Pool & Leonard 2011: 9).
d) Ratio: in which attributes have all the properties of interval scale attributes, with the addition of a fixed zero point (e.g. artefact length, width, weight) (Andrefsky 63-64; Van Pool & Leonard 2011: 9-10).

Table 4.10 presents general attributes only, i.e. common to all artefact types (with the exception of debris) which will be reviewed in the following subsections.

Cortex & Cortex Position

Archaeologists commonly refer to the outer geological patina of a flint nodule (or pebble, or block) as ‘cortex’ (Inizan *et al*. 1999: 137). Archaeologists also use the term “patina” to define the natural alteration of the outer part of an artefact, which develops after it has been knapped. Some authors, however, in order to avoid confusion with geological terms prefer to use the term “neo-cortex” instead of “patina” (e.g. Fernandes & Raynal 2006; Fernandes *et al*. 2008). I will stick to the term “patina” and refer to artefacts displaying it as “patinated”.

The amount and position of the corticated area on any artefact are considered effective indication of core reduction stages (Baumler & Downum 1989). At the same time, there is no conventional method to measure them effectively.

A compromise between using a computer digitizer to map the exact surface of each debitage piece and a nominal scale (i.e. absent/present) which would include in the same group entirely corticated pieces as well as pieces with only a corticated butt, was reached through the use of a six-category ordinal scale (a similar solution is suggested by Andrefsky 1998: 104) (Fig.: 4.2 and 4.3 and Table 4.11). Patinated artefacts were very rare at Rocca di Rivoli. For this reason, the presence of patina is signalled by the addition of “patina” or “patinated” in the comments field.

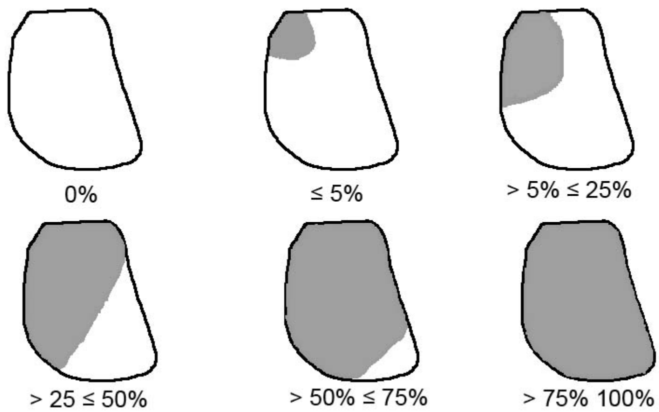


Fig. 4.2. Categories for recording cortex attributes (source: Author).

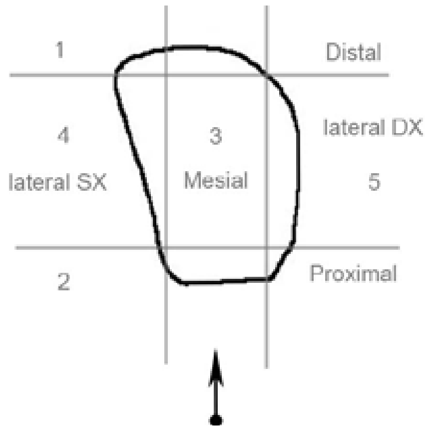


Fig. 4.3. Schematic representation of cortex position attributes (source: Author).

ID CORTEX	CORTEX DESCRIPTION
0	0
1	≤ 5%
2	> 5% ≤ 25%
3	> 25 ≤ 50%
4	> 50% ≤ 75%
5	> 75% 100%

Table 4.11.Nominal scale andcorresponding categories for recording cortex attributes.

Parent material

Detailed observations of cortex macro- and micro-morphology have been employed to indicate the provenance of raw material (e.g. Cremaschi 1981; Fernandes 1981; Slimak & Giraud 2007) and, in turn, to infer procurement strategies. Six different types of categories were identified on the basis of sampling of raw material outcrops in the Verona area undertaken for the present study (Table 4.12). Methodological limits and potentials of such definitions are discussed at length in Chapter 5, though it is useful to note here that in many cases it was not possible to recognise cortex features recorded during fieldwork since the artefacts, despite being fully corticated, were too small.

ID PARENT MATERIAL	PARENT MATERIAL TYPE
0	Not identifiable
1	Pebble: glacio-fluvial secondary depositis
2	Pebble/nodule secondary deposits
3	Pebble/nodule secondary depositsTerra Rossa
4	Nodule primary outcrops
5	Block primary outcrops

Table 4.12. Nominal scale and corresponding categories for parent material types.

Raw material

Six principle litho-types were identified in the Rocca di Rivoli assemblage on the basis of colour, texture and micro-fossil inclusions, as well as direct comparison with a reference collection put together during fieldwork sampling flint sources in the area (Table 4.13).

ID RAW MATERIAL	RAW MATERIAL
0	Not identifiable
1	Oolitico di San Vigilio
2	Scaglia Rossa
3	Scaglia Variegata
4	Maiolica
5	Rosso Ammonitico
6	Eocene
7	Other (specify in comments)

Table 4.13. Nominal scale and corresponding categories for raw material types.

Litho-type categories, whenever possible, were attributed to all the artefacts analysed, with the exception of those too small, burnt or patinated to identify raw material types.

Edge condition

Processes acting on artefacts after discard are both cultural and taphonomical (Schiffer 1976). Research on the latter has concentrated on post-depositional processes such as solifluction, cryoturbation and colluvial action, which have been recognised as potential culprits in compromising artefactual and stratigraphic integrity (e.g. Freeman 1978). There is also a growing understanding of the importance of groundwater, differential compaction, plant growth and soil fauna as well as human activities affecting site structure and artefact condition (e.g. Courtin & Villa 1982; McBrearty 1990; Schiffer 1983). Investigations of the effect of human or animal trampling on flint artefacts have pointed out how some of the fracturing resulting from it may resemble fresh retouch (e.g. Mobley 1982). The effects of trampling have been observed on replicated lithic assemblages, under controlled conditions (e.g. McBrearty *et al*. 1998; Nielsen 1991; Tringham *et al*. 1974), and although results differ considerably, all experiments highlight the presence of irregular, abrupt, edge modification on one or both faces, the blows often directed at nearly right angles to the edge, rather than obliquely. Bordes (1961: 45) defines such artefacts as pseudo-tools.

Macroscopic edge damage (Fig. 4.4) is also related to use of the artefact without previous retouch (e.g. gloss on sickle blades) as well as to manufacture (Newcomer 1975). However, a number of blind tests carried out by archaeologists (e.g. Odell & Odell-Vereecken 1980; Young & Bamforth 1990) have emphasised the high error rate in telling the two apart. Finally, authors have also cautioned on edge alteration occurring during excavation, laboratory processing and storage (Gero 1978). The latter was unfortunately recognised in the assemblage from Rocca di Rivoli, in the form of minuscule flint fragments mixed with flint powder found at the bottom of bags containing, at times, more than one hundred flint artefacts.

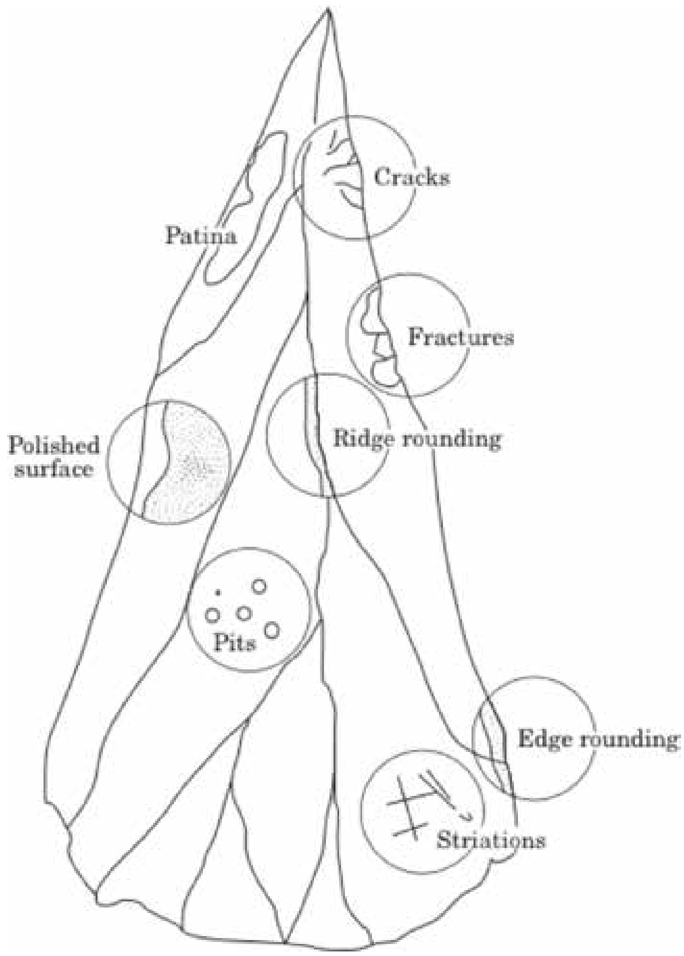


Fig. 4.4. Frequent natural modifications of a flint flake (from Burroni *et al.* 2002, Fig. 1).

In conclusion, only use-wear analysis can, in most cases, accurately identify use from unintentional edge modification. For the assemblage from Rocca di Rivoli "probably used" refers to modified artefacts edges which might have undergone a series of processes, with the inclusion of use, post-depositional disturbance and conservation damage (Table 4.14).

ID EDGE CONDITION	EDGE CONDITION	DESCRIPTION
1	Fresh	Edge is pristine, no traces of damage or pseudo-retouch.
2	Damaged	Edge presents dents or it is burnt badly. Artefact overall also shows signs of post-depositional damage (Fig. 4.4).
3	Probably used	Edge presents irregular removals on one or both faces, or gloss or macroscopic striations.

Table 4.14. Nominal scale and corresponding categories for edge condition recording.

Thermal alteration

Three different degrees of thermal alterations were identified (Table 4.15). Burnt artefacts were identified according to the presence of cracks, pot-lid fractures and colour alteration. Partially heated artefacts with a characteristic vitreous aspect and a more lustrous surface (Crabtree 1972: 94)were recorded as a separate category in the hope of recognising possible traces of heat treatment (Crabtree & Butler 1964). Heat treatment is a method of altering siliceous material by exposure to controlled heat, which makes flint artefacts more suitable for precise retouch, especially pressure flaking (ibid.).

ID THERMAL ALTERATION	THERMAL ALTERATION
0	Absent
1	Burnt
2	Partially heated

Table 4.15. Nominal scale and corresponding categories for recording thermal alteration attributes.

Ethnographic accounts from the 19th and early 20th centuries describe how the knapping of silica materials was facilitated by heat treatment. Observations of this process have been made around the world, including Bengal (Man 1883: 380), the western part of Oceania (Powell 1884: 160), northern Australia (Elkin 1948), southern Africa (Robinson 1938: 224) and parts of North America (for an exhaustive bibliography see Oulasson & Larsson 1982). These accounts differ considerably in terms of how heat treatment of the raw material was carried out, but some of the methods have been replicated by knappers (Purdy & Brooks 1971; Inizan *et al.* 1976; Griffiths *et al.* 1987) starting from the first experimental heat-treatment demonstration carried out by Don E. Crabtree in 1964 (Smith 1966).

Archaeological parallels have been identified on several occasions, especially within Upper Palaeolithic contexts (e.g. Bordes 1969: 197). In the Alpine VBQ context, a possible example of heat treatment was shown to me by Nicola Dal Santo (Fig. 4.5) on a retouched fragmented blade from the VBQII site of Via Guidorossi (Parma). On this example, heat treatment seems to be associated with retouching of the artefact edge. With this image in mind, a total of 20 retouched artefacts which showed indicative traces of partial heating were examined under a binocular microscope (100x) in order to identify, if present, heat treatment prior to retouching or knapping.

Fig. 4.5. Traces of heat treatment on a blade from via Guidorossi (Parma) (photo: courtesy of Nicola Dal Santo).

Colour and Colour Characteristics

Attribution of a colour to each artefact with the exception of debris, was undertaken using the Munsell Soil Colour Chart. Colour variability at both inter- and intra-formational level (and at times even within the same artefact) was recorded along with a series of colour pattern and texture attributes which help to characterize raw material types (Table 4.12). These are the same recorded during sampling of flint outcrops during fieldwork (please see Chapter 5 for further discussion).

ID COLOUR CHARACTERISTICS	COLOUR CHARACTERISTICS
1	Banded
2	Vitreous
3	Black inclusions
4	Zonations
5	Other (specify in notes)

Table 4.16. Nominal scale and corresponding categories for recording colour characteristics.

Weight

Each single artefact was weighed on a precision scale to the nearest 0.1 g.

Excavation records

Each artefact is associated with a unique number in the artefact database, which is in turn associated wit information retrieved from the excavation records and further work undertaken on the material (e.g. regional cataloguing programme, photographs, drawings) (Table 4.17).

EXCAVATION RECORDS	DESCRIPTION
Site Name	Rivoli
Excavation year	Any year between 1963 and 1968
Zone	Site L
Area	It is indicated with Roman numbers and refers to the trenches open up in Site L
Context	It is either a number in brackets e.g. (8) or a Roman number in square brackets [IV]
Feature	Represented as e.g. “Pit U”
Bag no.	Most bags are labelled with site, zone, area and context followed by a number
Photo no.	A selection of retouched tools and cores have been photographed, each photo as a serial number which is displayed here
Drawing no.	A selection of retouched tools and cores have been drawn, each drawing as a serial number which is displayed here
ICCD no.	A selection of retouched tools and cores were catalogued as part of Regione Veneto project, and are available online. The code reported here refers to the artefact code within the national archaeological artefacts catalogue.

Table 4.17. Attributes conveying information on excavation records and post-excavation work.

Category-specific attributes

A number of category-specific attributes have also been identified and recorded systematically selected for each artefact type. This section describes these in detail, discussing the reasons behind their choice in each case.

Cores and core biographies

Rather than describing and recording core typologies, which represent the static end result of all knapping stages, I have chosen to record attributes which supply information on core biographies, to trace the history of individual core reduction processes through the identification of:

- Raw material selected.
- Knapping stages and strategies.

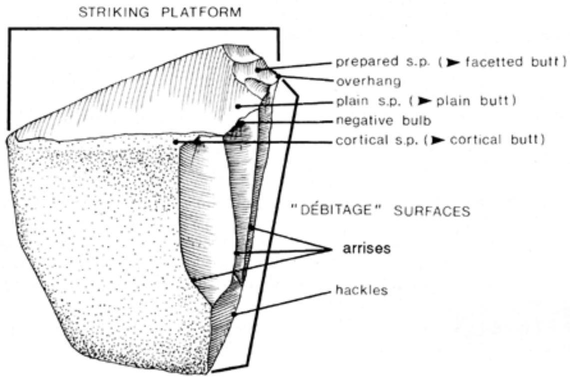


Fig. 4.6. Main descriptive terminology for cores which will be employed throughout the present work (from Inizan *et al.* 1999, Fig. 20).

Cores and pre-cores are best suited to provide information about original type, size (Table 4.18) and shape (Table 4.19) of parent materials (Bradbury & Carr 1995; Marshall 2000). When compared with types, sizes and shapes available at raw material sources, it becomes clear which selection criteria existed. In addition, differences in opening strategies might be explored in relation to raw material type, shape and size.

ID PARENT MATERIAL DIMENSIONS	PARENT MATERIAL DIMENSIONS
0	Not identifiable
1	Small <5cm
2	Medium 5-10 cm
3	Large >10cm

Table 4.18. Categories for recording parent material dimensions attributes.

ID PARENT MATERIAL SHAPE	PARENT MATERIAL SHAPE
0	Not identifiable
1	Angular
2	Sub-angular
3	Rounded
4	Sub-rounded

Table 4.19. Categories for recording parent material shape attributes.

Types of removals and their direction (Table 4.20), together with the identification of the striking platform area (Table 4.21) and count of striking platforms, are indicators of knapping stages (Castañeda 2009; Finlayson *et al*. 2000) which in turn point to methods and techniques employed by the knapper.

ID REMOVAL TYPE	REMOVAL TYPE
1	Bladelets
2	Blades
3	Blades & Bladelets
4	Flakes
5	Mixed (Blades & Flakes)

Table 4.20. Categories for recording removal type attributes.

ID STRIKING PLATFORM AREA	STRIKING PLATFORM AREA (% OF TOTAL CORE SURFACE)
1	<5%
2	>5% ≤ 25%
3	>25% ≤ 50%
4	>50% ≤ 75%
5	>75%

Table 4.21. Categories for recording core striking platform area (approximate % value of entire core surface).

Cores may reach the archaeological record at different stages of the knapping sequence (Table 4.22). The number of striking platforms, along with the maximum length and width of the last removal supply information on the degree of exploitation of the raw material and on the knapping method employed.

ID UTILIZATION STAGE	UTILIZATION STAGE
1	Test
2	Core preparation
3	Exhausted
4	Reduction under way
5	*Remise en forme*

Table 4.22. Categories for recording core utilization stage attributes.

Cores present a wide range of morphological variability which is difficult to measure consistently in terms of size. Although length, width and thickness are usually given as size measurements (Andrefsky 1998: 138), formal definitions are often difficult to find, failing therefore to provide the replicability needed to compare data between assemblages.

The definition of core length as the longest measurement perpendicular to the striking platform and parallel to the removal of detached pieces (ibid.) presents problems at Rocca di Rivoli because multidirectional/rotated cores, which are especially common at the site, have more than one platform used to produce debitage. In such cases, Andrefsky (ibid.) suggests core size is best characterised by a combination of weight and Maximum Linear Dimension (MLD). In fact, for most cores, regardless of their shape, it is possible to recognise one greatest linear dimension. At the same time, the coefficient obtained in this way remains an abstract value. I chose to adopt the more traditional method of measuring length (which equals the MLD), width (approximately orthogonal to length) and thickness (measured from one side to the other of the hypothetical MLD). These measures, with the exception of MLD, lack replicability but have the merit of conveying an approximate volumetric idea of the artefact.

Reasons for core discard cannot be confidently identified in most cases but it may be possible to recognise intentional interruption (i.e. a tested core left aside for later re-use, or a core with noticeable raw material faults, etc.) and irreversible knapping accidents or exhaustion. A knapping accident observable on cores is platform crushing. A core platform might at times display a series of small fractures on the main flaking surface along the platform edge (small step fractures, incipient cones etc.). Other accidents are represented by hinged or stepped fractures on the main flaking surface. Size reduction, however, was probably the major cause for core abandonment. An approximate idea of how intensively a core was exploited can be obtained by comparison of sizes of cores (in addition to width and length of last removal) and those of debitage and tool blanks (Nishiaki 2000).The presence of knapping mistakes, such as incipient cones on the striking platform or a crushed platform, can also be an indicator of the knapper's lack of expertise (e.g. Bamforth & Finlay 2008; Milne 2005).

ID CORE ABANDONMENT	CORE ABANDONMENT
0	Not identifiable
1	Dimensions
2	Faults raw material
3	Repeated steps on debitage surface
4	Irreversible mistake (step, otrepassè)
5	Angle
6	Crushing of striking platform
7	Other (specify in notes)

Table 4.23. Categories for recording core abandonment attributes.

ID ACCIDENTS	ACCIDENTS
1	Languette
2	Nacelle
3	Plunged
4	Hinged/Stepped*
5	Incipient cones on striking platform*
6	Lipped bulb
7	Siret
8	Other (specify in notes)
9	Crushed platform*
10	Overhanging platform*

*most likely to be recorded on cores.

Table 4.24. Nominal scale and corresponding categories for recording knapping accidents attributes.

Debitage

Flakes and blades which have not seen further modification through retouching of their margins (or surfaces) belong to the debitage category. Most attributes described here are also valid for retouched artefacts.

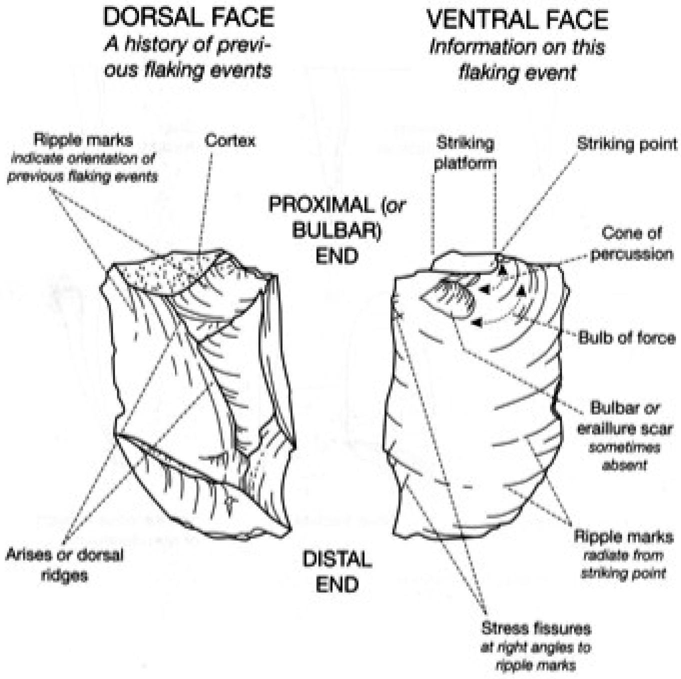


Fig. 4.7. Main descriptive terminology for debitage which will be employed throughout the present work (from Hurcombe 2014, Fig. 8.9).

All debitage was measured in terms of length, width and maximum thickness. Measurements are in millimetres. Length was defined as the linear distance between platform and distal termination, whereas width as the greatest linear distance between the two intact lateral edges (Fig. 4.8). Platform thickness was measured at the point of maximum extent on the line perpendicular to that representing the striking platform width (Odell 1989: 168-69).

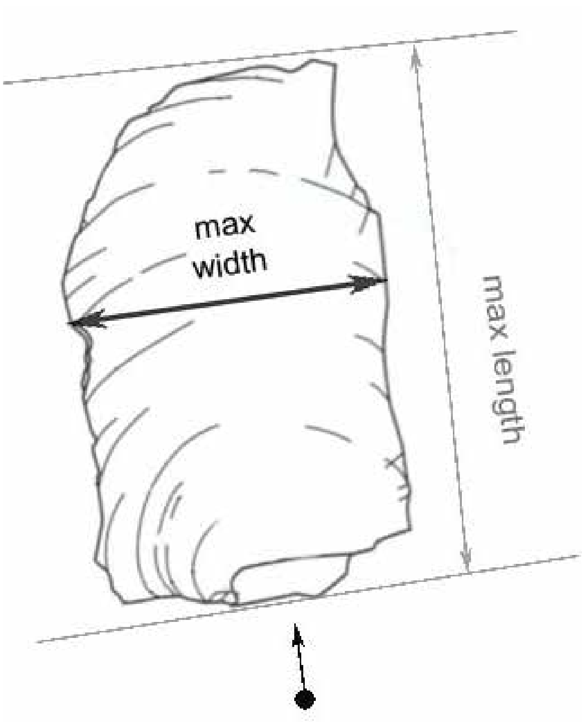


Fig. 4.8. Schematic representation of length and width measurement (source: Author).

Platform thickness, together with other variables (Table 4.25) is used to infer the type of hammer used (hard/soft), but also the flaking method employed by the knapper. Hammers used for flaking and retouching flint cores may be of stone, animal bone or antler (Tixier *et al*. 1980: 96) and may be used to strike the rock directly or indirectly by means of a punch. Hammers are conventionally distinguished as 'hard' (i.e. as hard as or harder than the material being flaked) and 'soft' (antler and bone but also soft limestone rocks). At Rocca di Rivoli, probable hammers were identified by means of use-wear trace analysis (Lunardi 2008).

No use-wear analysis was undertaken on the bone tools found on site but no antler or bone percussors were immediately recognised (Barfield & Bagolini 1976: 127-131). There are, however, other means to infer the flaking mode (*sensu* Newcomer 1975: 97). Bordes (1961) described flakes detached with a hard hammer as having large butts, clear points and cones of percussion, pronounced bulbs, and clear conchoidal ripples, whereas the flakes detached with a soft hammer were described as having narrow butts, no points or cones of percussion and diffused bulbs.

Ohnuma and Bergman (1982) conducted a series of experiments to define possible criteria for distinguishing between debitage created by hard and soft hammers, and tested their usefulness with blind tests (Table 4.25). By using those criteria they obtained results with acceptable accuracy in the blind test (over 90%), but they observed - as a note of caution - that soft stone hammers may produce features practically indistinguishable from those obtained by soft hammer such as deer antler. Their definition of hard and soft hammer is therefore only relative to the hardness of the stone being flaked (ibid). Hayden and Hutchings (1989: 253) compiled a similar list of possible criteria, also generated from replication studies, in which they stated that "taken individually, few of these attributes provide totally accurate indicators [...]. However, taken together, they can lead to the nearly certain identification of most flakes as hard or soft hammer flakes". The present study employs these established criteria for distinguishing between the use of hard and soft hammers.

FEATURES	HARD(ER) HAMMER	SOFT(ER) HAMMER
Point of Percussion	Clear	Vague
Cone of Percussion	Clear	Vague
Fracture marks	Pronounced	Unpronounced
Butt lip	Absent	Present
Bulb	Pronounced	Diffused

Table 4.25. Ohnuma and Bergman's (1982) criteria to distinguish between the adoption of hard and soft hammers.

Another, albeit indirect, attribute contributing information on the techniques and methods employed by the knapper is the portion of striking or pressure platform detached during removal and therefore surviving on the blade, flake or tool, i.e. the butt. Butt morphology (Table 4.26

and Fig. 4.9) is therefore affected by techniques applied and reflects the type of preparation which went into shaping the core striking platform.

ID BUTT TYPE	BUTT TYPE	DESCRIPTION
1	Cortical/unprepared	With cortex or natural: there is no prepared striking platform (Fig. 4.31, no. 1)
2	Plain simple	Single knapped surface (Fig. 4.31, no. 2).
3	Facetted	Several previous removals (facets) detached during preparation of platform (Fig. 4.31, no. 3)
4	Dihedral	Two negatives separated by an arris (Inizan *et al*. 1999) (Fig. 4.31, no. 4)
5	En chapeau de gendarme	A specific facetted butt defined by Bordes (1947) (Fig. 4.31, no. 5)
6	Winged	Results from the removal of two exactly superposed flakes. Lateral margins of butt resemble wings (Fig. 4.31, no. 6)
7	Pecked/piquet	Has been isolated by means of tiny strikes probably carried out with a pointed instrument, as a result in general the central part stands out from the rest (Fig. 4.31, no. 7)
8	Spur/en eperon	Presents two series of small convergent removals isolating a spur (éperon) (after Karlin 1972: 268, Fig. 18) (Fig. 4.31, no. 8)
9	Linear	Resembling a line (Fig. 4.31, no. 9)
10	Punctiform	Like a point (Fig. 4.31, no. 10)
11	Other (specify in notes)	
13	Damaged	Only a portion of it is present
14	Abraded	Summary preparation took place by means of abrasion
15	Retouched	Retouched as part of tool edge

Table 4.26. List of attributes and their description for recording butt morphology variables.

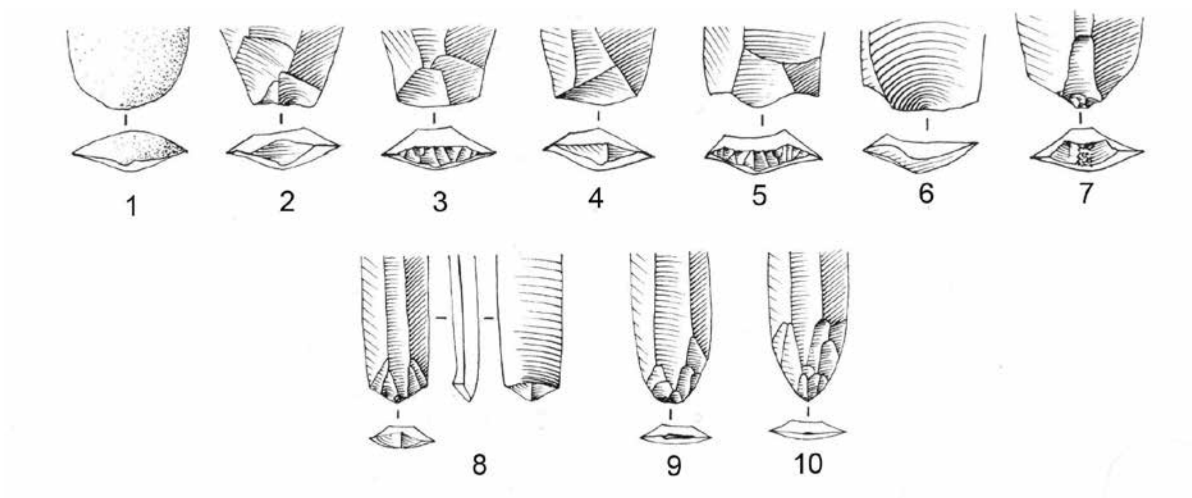


Fig. 4.9. Butt morphology variability (from Inizan *et al.* 1999, fig. 62). 1: cortical/unprepared; 2: simple; 3: facetted; 4: dihedral; 5: "*en chapeau de gendarme*"; 6: winged; 7: pecked; 8: spur or "*en éperon*"; 9: linear; 10: punctiform.

Knapping direction is also a variable controlled by the knapper. Results of this choice are detectable both on the main core flaking surface and on the dorsal sides of debitage and tools (Table 4.27 and Fig. 4.10).

ID DORSAL MORPHOLOGY	DORSAL MORPHOLOGY
10	Unidirection
11	Opposed
12	Side DX
13	Side SX
14	Radial
15	Random
16	Convergent
18	Step
19	Damaged
20	Crested
1012	Unidirectional-Side DX
1013	Unidirectional-Side SX
1112	Opposed-Side-DX
1113	Opposed-Side-SX
171	Y-Upsilon Proximal
172	Y-Upsilon Distal
21	Other (specify in notes)
22	Cortical
23	Unidirectional-Opposed
24	Opposed-Unidirectional
25	Side DX-Side SX
26	Repeated step fracture

Table 4.27. List of attributes and their description for recording dorsal morphology variables.

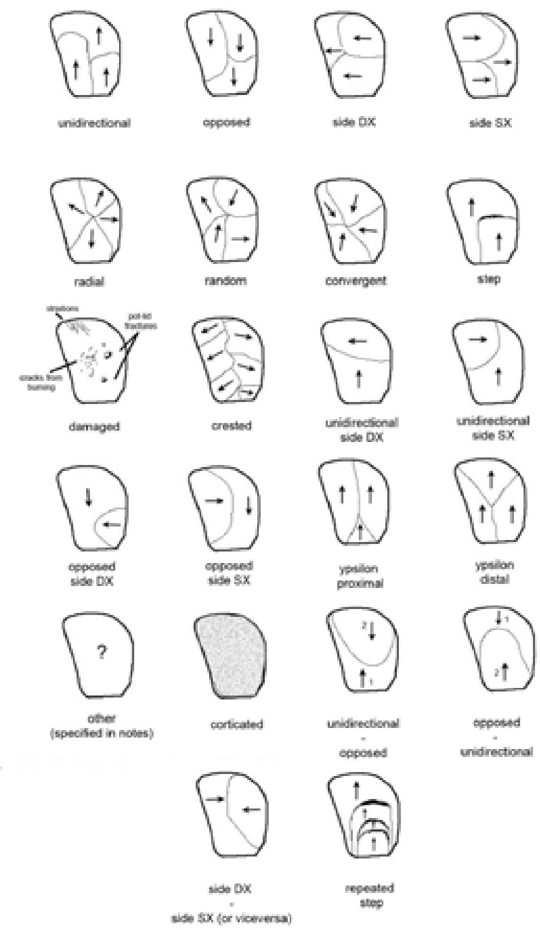


Fig. 4.10. Dorsal morphology varia-bility: attribute classes employed in the present study (source: Author).

It has been pointed out on several occasions (e.g. Inizan *et al.* 1999) that blade production often implies careful core preparation which results in the production of flakes with distinctive traits. In addition to the attributes described so far, an additional five attribute categories have been selected to be recorded for blades (and flakes coming from blade cores; so-called 'blade-like-flakes').

The first is the presence of parallel edges, since these are indicative of the degree of skill of the knapper in preparing both platform and debitage surface in order to obtain a fine, long blade with parallel edges. The second attribute relates to distal end morphology. It has been pointed out that the recurrence of a determinate type of distal shape might point to the use of a particular flaking technique (e.g. Cotterell *et al*. 1985).

ID DISTAL SHAPE	**DISTAL SHAPE**
1	Curved to right
2	Curved to left
3	Rectilinear
4	Upsylon
5	Round
6	Pointed
7	Accident
8	Irregular/Damaged
9	Retouched
10	Diagonal

Table 4.28. List of attributes and their description for recording distal end variables.

Thirdly, the profile of blades was examined (Table 4.29), as this can indicate the presence of a certain style in debitage production, while also conveying technological information on core reduction strategies (e.g. Bergman 1987).

ID PROFILE	**PROFILE**
1	Straight
2	Concave
3	Convex
4	Twisted

Table 4.29. List of attributes and their description for recording blade profile types.

The fourth attribute is blade transverse section morphology, which is examined at the mesial portion of any blade (whenever available). The type of transverse section reflects the number of ridges on the dorsal surface of the blade, which in turn contributes to the recognition of knapping techniques and core reduction strategies. (e.g. Lea 2004, Nishiaki 2000).

ID TRANSVERSE SECTION	TRANSVERSE SECTION
1	Triangular
2	Lens shaped
3	Trapezoidal
4	Polygonal

Table 4.30. List of attributes and their description for recording blade transverse section types.

Fifth and final, the degree of platform preparation was recorded on blades, since this generally displays a more accurate preparation than the one found on flakes (Table 4.31). The degree of platform preparation can be inferred by recognising the "overhang removal technique" used to eliminate the overhang formed by the platform and depressions left by previous debitage removals in order to obtain a suitable angle and/or a stronger platform edge for flake production (Dibble & Whittaker 1981). Two very common types of overhang removal are exterior platform faceting and abrasion.

ID PLATFORM PREPARATION	PLATFORM PREPARATION	DESCRIPTION
0	Unprepared	No preparation.
1	Abraded/summary preparation	Abrasion has been employed to smooth platform edge and/or remove overhang.
2	Simple	Overhang was taken away by one removal.
3	Complex	Platform and proximal end of debitage surface was carefully shaped by accurately removing tiny micro-flakes.

Table 4.31. List of attributes and their description for recording degree of platform preparation in blades.

As briefly outlined above, debitage attribute analysis is complemented by debitage typological analysis which records the presence within the assemblage of specific knapping products (Table 4.32 and Figs. 4.11 - 4.14).

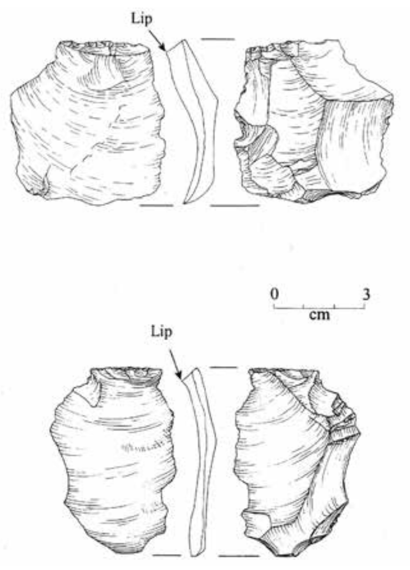


Fig. 4.11. Examples of bifacial thinning flakes (from Andrefsky 1998, fig. 6.2).

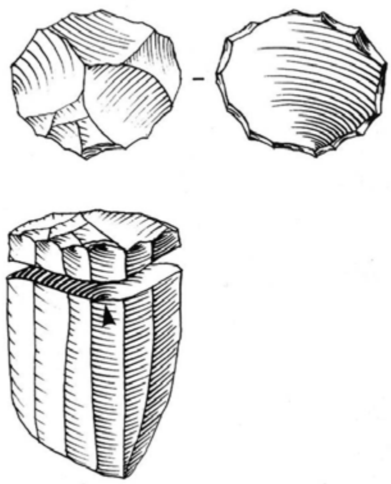


Fig. 4.12. Example of core Tablet (from Inizan *et al.* 1999, fig. 77-1).

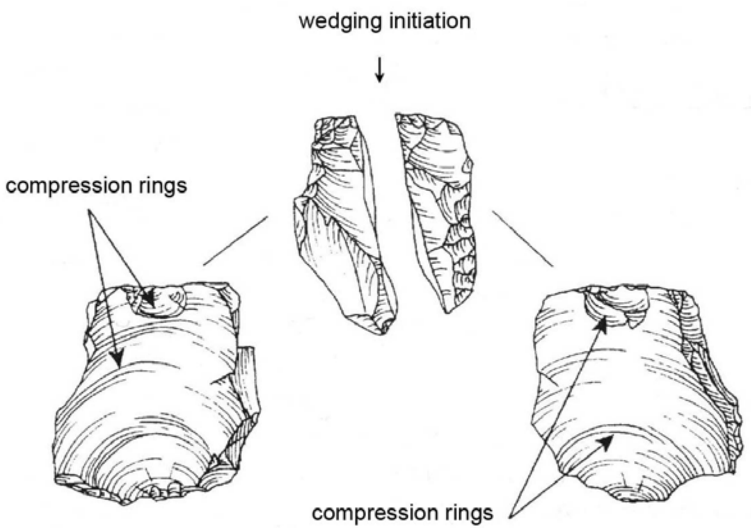


Fig. 4.13. Example of splintered piece (from Andrefsky 1998, fig. 6.3).

ID FLAKE TYPE	FLAKE TYPE	DESCRIPTION
1	Core preparation	Flakes characterised by unprepared or corticated butts and cortex (75%+) on their dorsal face.
2	Core reduction	Flakes with no distinctive attributes associated with specific stages in the reduction sequence.
3	Rejuvenation of debitage surface	Depending on the knapping mode adopted, flakes detached to rejuvenate the debitage surface display high variability. It has been observed that a recurrent way of core rejuvenation and *mise-en-forme* is represented by the detachment of plunged flakes or blades. However this is only one of many possibilities.
4	Bifacial preparation	Bifacial thinning flakes have faceted and narrow platforms and intersecting flake scars on the dorsal side from prior flake removal. In addition they are often curved in profile and they at times present a lipped butt (Andrefsky 1998: 118; Crabtree 1972: 96) (Fig. 3.22).
5	Retouch flake	Thin and tiny flakes (less than 0.5 cm) removed during retouching of artefact edges.
6	Platform trimming	Debitage that retains part(s) of the original core from which they were detached. They are usually produced in the course of core platform rejuvenation and maintenance.
7	Core Tablets	Core Tablets are flakes removed from just beneath the main striking platform, perpendicular to the direction of former removal (often associated with unidirectional cores, e.g. Morlan 1970) (Fig. 3.23).
8	Piece esquilleé/ Splintered	This type of flake is obtained by smashing a core between the hammer and an anvil stone. The detached piece shows considerable morphological variation but it is generally characterised by opposed bifacial crushing, battering and the lack of bulbs of percussion on either end (Andrefsky 1998: 119-120) (Fig. 3.24).
9	Burin spall	Part of the blank that has been detached by the burin blow technique (cf. Inizan *et al*. 1999: 132). (Fig. 3.25).
11	Other (specify in notes)	
12	Roughout/pre-form	Any artefact which has been modified to an intended stage of lithic reduction sequence in a specified assemblage. It must have the morphological potential to be further modified into a tool type within the assemblage.

Table 4.32. List of flake type categories and their attributes description.

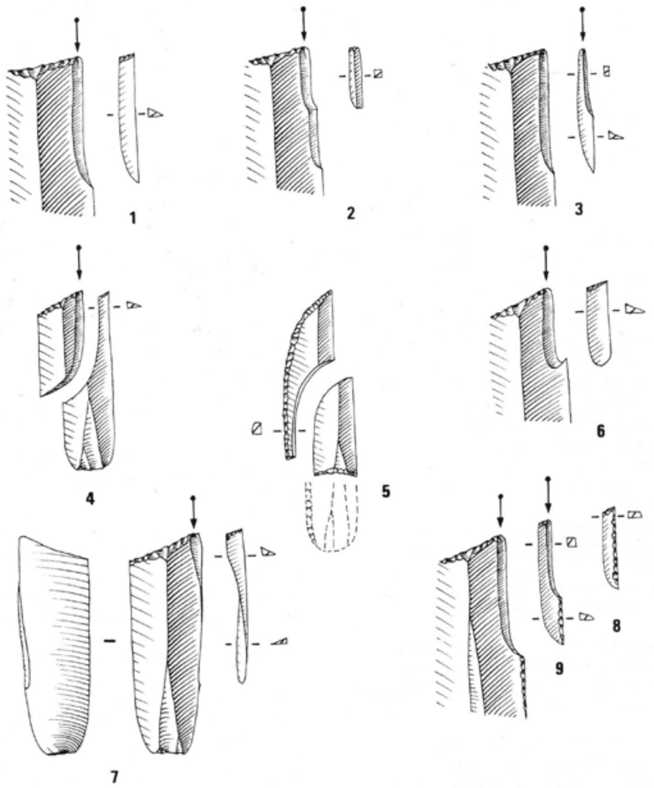


Fig. 4.14.. Main types of burin spalls. 1: first spall; 2,3: sharpening spalls; 4: plunging spall; 5: plunging spall on a proximally truncated arched backed blade; 6: hinged spall; 7: twisted spall; 8, 9: first spall and sharpening spall removing part of the edge prepared before the burin blow (from Inizan *et al.* 1999, fig. 61).

A special category of debitage type is represented by artefacts which have resulted from an unintentional knapping accident, which may occur during flaking, shaping and re-shaping of the core or retouching of a debitage piece (Roche & Tixier 1982). Experimental replication has dealt with knapping accidents at length and has identified a number of accident types (and resulting debitage types). These have been confirmed by the presence of identical types within archaeological assemblages (Inizan *et al.* 1999: 34). Experimental archaeology has also identified probable causes, such as flaws in the raw material and mismanagement by the knapper of one or a combination of knapping variables (angle of blow, misjudgement of load applied, inaccuracy of blow on striking platform; miscalculation of core platform angle, etc.). These errors affect the continuation of the reduction sequence to varying degrees: some might be irreversible (such as when a tool is broken into two halves during retouching), while others might be put right (such as a hinge fracture on the core debitage surface), but there are also some which are of no relevance whatsoever (e.g. fracture of a burin spall during removal).

There are a number of so-called ‘accident’ type flakes (Table 4.33 and Fig. 4.15) which have been found to occur over and over again. For instance, the “kombewa” or “janus” flake (a flake with two lower faces, after Balout *et al.* 1968), which is characteristic of a still little known African Palaeolithic *chaîne opératoire* pre-dating the Levallois method (Dauvois 1981), or the plunged flake/blade which is used to re-shape the convexity of the debitage surface during core maintenace or “*re-mise en forme*”.

ID ACCIDENT TYPE	ACCIDENT TYPE	DESCRIPTION
1	Languette	Resulting from the unintentional fracture of a blade during knapping (Bordes 1970). The fracture wave appears to travel first along the surface of one of the faces before plunging suddenly, and then slanting out on the opposite face. It is more likely to occur when direct percussion with a soft hammer or indirect percussion are applied (Inizan *et al*. 1999: 144)
2	Nacelle	Fractures developing not far from the butt. When the fracture wave suddenly arches towards the upper face, removing part of the two edges, it travels alongside the faces for a few millimetres and suddenly intersects the lower face. The nacelle is plainly visible on the lower face of the blade, and the small corresponding waste product also bears a specific morphology. This type of break is rather rare and associated with pressure flaking (Inizan *et al*. 1999: 146).
3	Plunged	Plunging flakes occur when the fracture plane, although normal in its proximal zone, arches sharply and tears away a whole section of the core. Plunging pieces may be produced by accident but also to rejuvenate the core main flaking surface intentionally (Inizan *et al.* 1999: 149-151).
4	Hinged	Hinged flakes occur when the fracture plane, normal in its proximal zone, arches suddenly to intersect prematurely the upper face of the blank, resulting in a shorter than expected piece. This accident often occurs in association with improper platform angle and flaking direction (Inizan *et al*. 1999: 143; Crabtree 1972: 37).
5	Incipient cone(s)	Hammers striking the wrong portion of the core striking platform (i.e. usually too far from the edge) produces a circular micro-fracture on the surface.
6	Lipped bulb	A lip is a slight projection of the ridge formed by the butt and the lower face. According to Davois (1976: 168) in the bulb area, a countercurve topped by a lip is formed where the fracture meets with the surfaces of the striking platform. This trait is characteristic of flakes removed by a soft hammer (Crabtree 1972: 41).
7	Siret	Siret breaks happen when, during separation of a flake two perpendicular flaking planes develop, the second one separating the flake into two more or less equal parts (cf. Bordes 1961: 32). This type of accidental break is common in flakes removed with a hard hammer (Inizan *et al*. 1999: 160 and fig. 77). It occurs less frequently in blades, as well as when a soft hammer is used or when indirect percussion is applied. The frequency of its occurrence is also linked to the quality of the raw material (more common with coarse-grained texture lacking homogeneity).
8	Other (specify in notes)	
9	Crushed platform	Repeated striking of the wrong part of the core, either too close to or too far in from the edge, causes the platform to weaken and to crumble, thus hindering the successful knapping of additional flakes/ blades.
10	Overhanging platform	On a core is the projection overhanging the negative bulb of a previous removal. On a flake this turns into a butt overhanging the dorsal side. Overhang abrasion prior to detaching a flake or blade eases knapping, but this is not necessary. The presence or absence of an overhang provides information about the types of preparation techniques (Inizan *et al*. 1999: 147).

Table 4.33. List of accident type categories and their attributes description.

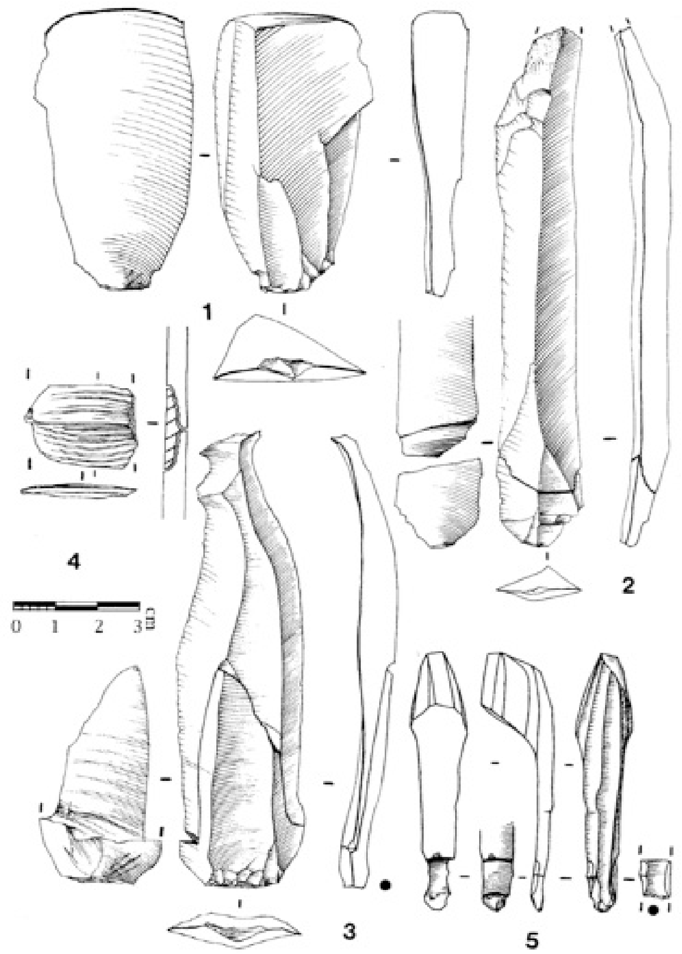


Fig. 4.15. Examples of main knapping accidents. 1: Hinged flake; 2: Blade with a lower face *languette*; 3: Blade with a long upper face *languette;* 4: Parasitical flake between two opposite *languettes;* 5: Plunging bladelet with a lower face *nacelle* break (from Inizan *et al*. 1999, fig. 7).

Retouched artefacts

In addition to the attributes presented and discussed so far, retouched artefacts display one or more retouched edges which also need to be recorded and described, since retouching affects the artefact morphology and is held to have a functional (as well as stylistic) purpose. Retouching has been defined as the "structuring, sculpting and intentional transformation of a blank" (Inizan *et al*. 1999: 153). Retouching, however, is not always used to create a working edge but it is also employed to modify an edge to facilitate its hafting or handling (e.g. Beyries 1988: 220; Cahen *et al*. 1979: 681). In addition, researchers have shown (e.g. Keeley 1980, 1982) that a single artefact may have different edges for use with a variety of tasks, thus one retouched edge may have had different functions.

Nine attribute categories have been isolated in order to describe retouched edges:

1. Position.
2. Localization.
3. Distribution.
4. Delineation.

5. Regularity.
6. Angle.
7. Extent.
8. Morphology.
9. Special techniques.

Retouch position refers to the location of the retouch relative to the artefact surfaces (Table 4.34 and Fig. 4.16). Both hard and soft hammers might be used to retouch artefact edges, and pressure flaking is generally associated with bifacial retouching.

ID RETOUCH POSITION	RETOUCH POSITION	DESCRIPTION
1	Upper face	On the upper or dorsal face.
2	Lower face	On the lower or ventral face.
3	Alternating	Retouch removals alternately stemming first from one face and then from the other on the same edge of the tool (Inizan *et al*. 1999: 129).
4	Alternate	Retouch removals are first detached from one face along one edge and subsequently from the opposite face along the other (Bordes 1961: 29).
5	Crossed	Retouch removals stem from both faces more or less at right angles (Inizan *et al*. 1999: 138). This technique has been replicated effectively with the use of an anvil (Tixier 1963).
6	Bifacial	Removals from both faces and along the same edge.

Table 4.34. Retouch position attributes.

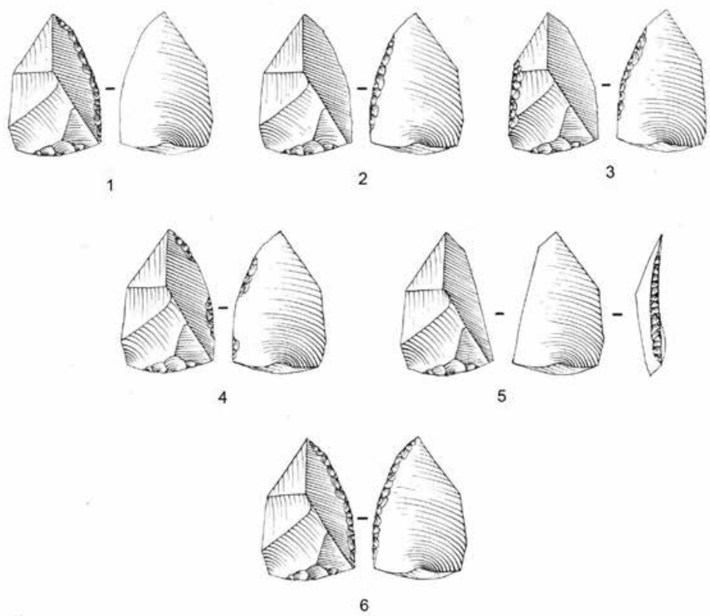


Fig. 4.16. Position of retouch removals. 1: upper face; 2: lower face; 3: alternating; 4: alternating; 5: crossed; 6: bifacial (from Inizan *et al*. 1999, fig. 75).

A further attribute to record is retouch localization, according to the standard orientation (when discernible) of the artefact. Table 4.35 presents the list of attributes adopted in the present study.

ID RETOUCH LOCALIZATION	RETOUCH LOCALIZATION
1	Covering upper
2	Covering lower
3	Distal upper
4	Distal DX upper
5	Distal SX upper
6	Distal lower
7	Distal DX lower
8	Distal SX lower
9	Proximal upper
10	Proximal DX upper
11	Proximal SX upper
12	Proximal lower
13	Proximal DX lower
14	Proximal SX lower
15	Mesial upper
16	Mesial lower
17	Lateral DX upper
18	Lateral SX upper
19	Lateral DX lower
20	Lateral SX lower

Table 4.35. Retouch localization attributes.

Distribution refers to the patterning of retouch removals along an edge (Table 4.34 and Fig. 4.17), whereas delineation describes the outline of the edge created by a line of removals (Table 4.35 and Fig. 4.18).

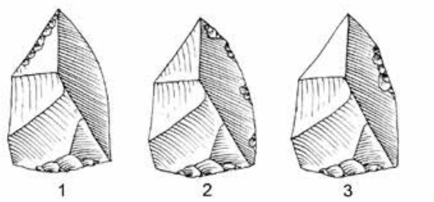


Fig. 4.17. Distribution of retouch removals. 1: continuous (on SX distal); 2: discontinuous; 3: partial (from Inizan *et al.* 1999, fig. 66).

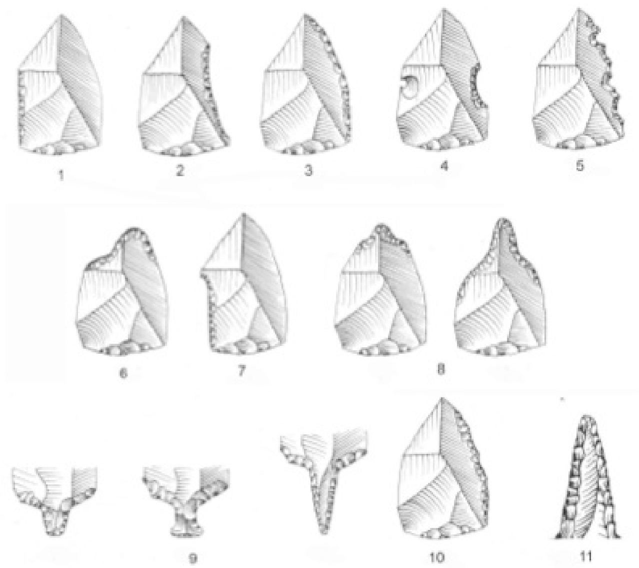


Fig. 4.18. Delineation of retouched edge. 1: rectilinear; 2: concave; 3: convex; 4: notched; 5: denticulated; 6: shoulder; 7: cran; 8: tongue; 9: tang; 10: irregular; 11: point. (from Inizan *et al.* 1999, fig. 65).

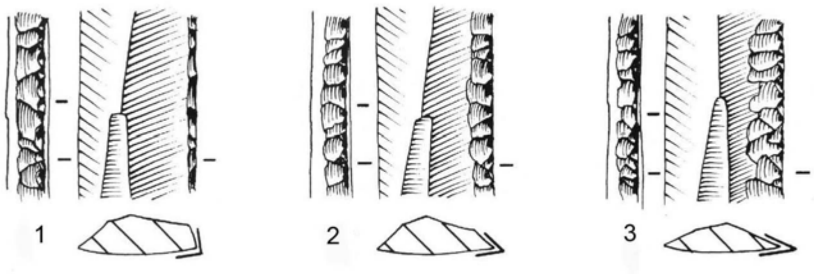


Fig. 4.19. Retouch angle morphology (from Inizan *et al*. 1999, fig. 56).

ID RETOUCH DISTRIBUTION	RETOUCH DISTRIBUTION
1	Continuous
2	Discontinuous
3	Partial

Table 4.36. Retouch distribution attributes.

ID RETOUCH DELINEATION	RETOUCH DELINEATION
1	Rectilinear
2	Concave
3	Convex
4	Notched
5	Denticulated
6	Shoulder
7	Cran
8	Tongue
9	Tang
10	Irregular
11	Point

Table 4.37. Retouch delineation attributes.

Retouch might take place spontaneously during use. Replication studies have noticed that this type of retouch appears to be less regular than intentional retouch (McBrearty *et al*. 1998). Utilization of a retouched artefact also causes tiny flakes to be removed from the edge being used (and previously retouched). In addition, spontaneous retouch can be caused by post-depositional taphonomical factors. It is at times difficult to distinguish between spontaneous and intentional retouch. The attribute of regularity was selected for this reason, to attempt to distinguish between these two very different aspects. Regular retouch is characterised by a sequence of removals which show similar traits (extent, morphology, angle). Nonetheless, the presence of a regular or irregular retouch should be interpreted with some caution since the degree of individual knapper's skill also contributes to the overall appearance of the final retouch.

ID RETOUCH ANGLE	RETOUCH ANGLE	DESCRIPTION
1	Abrupt	Approximately 90°
2	Semi-abrupt	Approximately 45°
3	Low	Very acute, ca. 10-20°

Table 4.38. Retouch angle attributes.

The angle formed by removals relative to the face from which they stem has also been recorded, albeit approximately, solely relying on macroscopic observation. Together with angle, a variable difficult to measure consistently is the extent of retouch. Irrespective of the proportions of each removal, four attribute classes were isolated (Table 4.39 and Fig. 4.20).

ID RETOUCH EXTENT	RETOUCH EXTENT	DESCRIPTION
1	Short	If only a small surface on the edge is concerned (1 to 3 mm)
2	Long	If removal reach towards the centre of the artefact (more than 3mm)
3	Invasive	Covers a large portion of the face
4	Covering	It affects the entire face

Table 4.39. Retouch extent attributes.

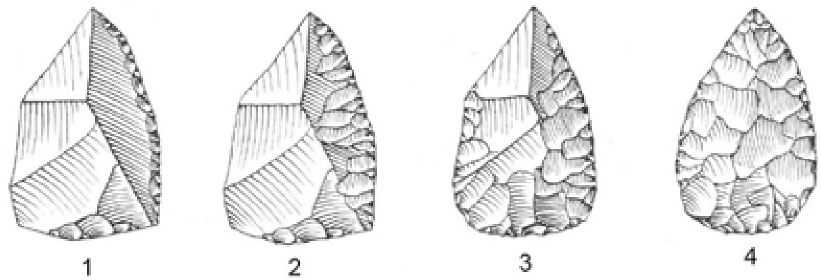


Fig. 4.20. Extent of retouch (from Inizan *et al.* 1999, fig. 67).

ID RETOUCH MORPHOLOGY	RETOUCH MORPHOLOGY	DESCRIPTION
1	Scaled	Wide, short removals, wider in their distal end than in their proximal end, bearing a close resemblance to fish scales (Bordes 1961:8).
2	Stepped	Morphologically similar to scaled removals, however removals distal ends are generally hinged, leaving a step (more or less pronounced) in the distal end of the negative.
3	Parallel	A series of removals (whose length is usually greater than their width)
4	Sub-parallel	A series of removals (whose length is usually greater than their width) separated by arrises that are roughly parallel (Inizan *et al*. 1999: 146)
5	Crossed	Parallel, more often subparallel, or a mixture of the two, associated exclusively with crossed position together with an abrupt angle.

Table 4.40. Retouch morphology attributes.

Some special techniques and methods leave distinctive and easily recognisable waste products. In a similar way some retouching techniques leave distinctive negative marks and corresponding waste products that deserve a special, separate place in flint flaking technology.

Special techniques

A number of special techniques were used, sometimes marking the ultimate stage of manufacture (Table 4.41).

ID SPECIAL TECHNIQUES	SPECIAL TECHNIQUES
1	Burin
2	Tranchet
3	Micro-burin
4	Coche clactonienne
5	Thermal use flaking
6	Serial flaking

Table 4.41. Retouch special techniques attributes.

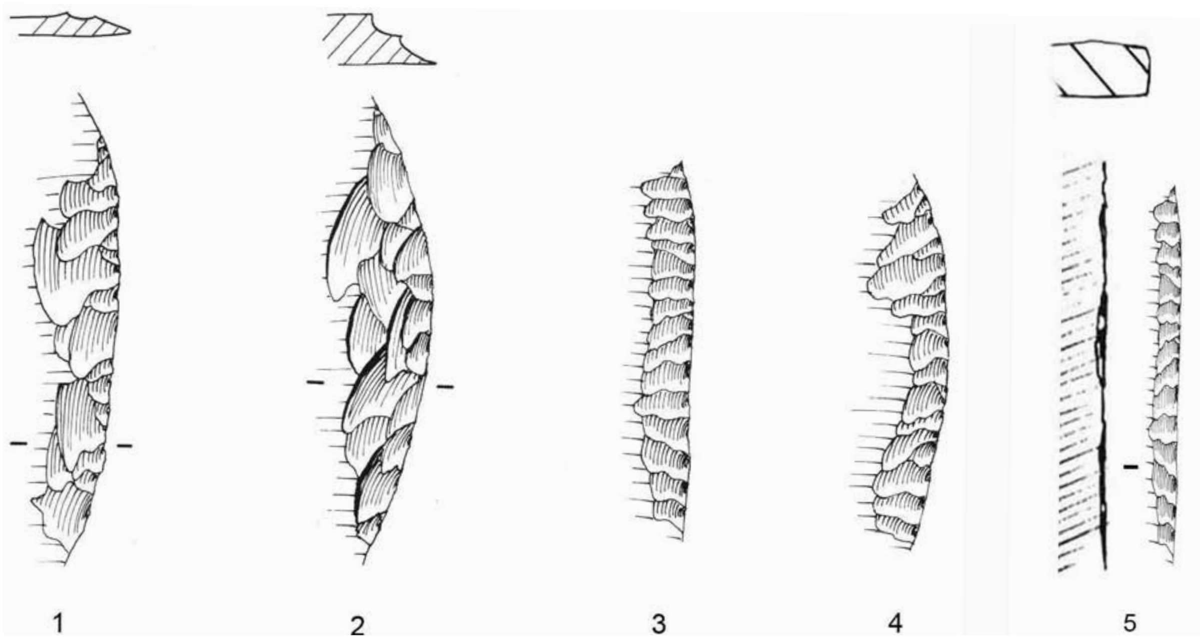


Fig. 4.21. Retouch morphological classes (from Inizan *et al*. 1999, fig. 67).

Burins

The burin blow technique is also a particular retouch technique which uses an artefact surface (either prepared or not) as a platform to detach, by pressure or percussion, a burin spall: i.e. an elongated fragment, leaving one or more burin facets. Several burin blows can be produced on a single blank and, as any position is possible, combinations are innumerable (Fig. 4.22). Since a single burin blow can produce several spalls, sharpening by one or more burin blows can only be proved by means of refitting and/or the presence of traces of use - except perhaps in the case of complete repair (for instance a truncated burin with a new burin blow applied on the other edge: Fig. 4.23, 5). Although systematically recorded, the characteristic waste products of burins, spalls and sharpening spalls, are rarely included in the technological analysis of a lithic assemblage (Inizan *et al.* 1999: 84), perhaps because stylistic variations are virtually infinite. However, there are some types of burins that have been found to characterise certain periods. For example, the “Ripabianca burin” is found in the early Neolithic, whereas the “Noailles” burin is common in the Upper Palaeolithic. Burin spalls can be retouched and thus become tools, such as spalls turned into drill-bits.

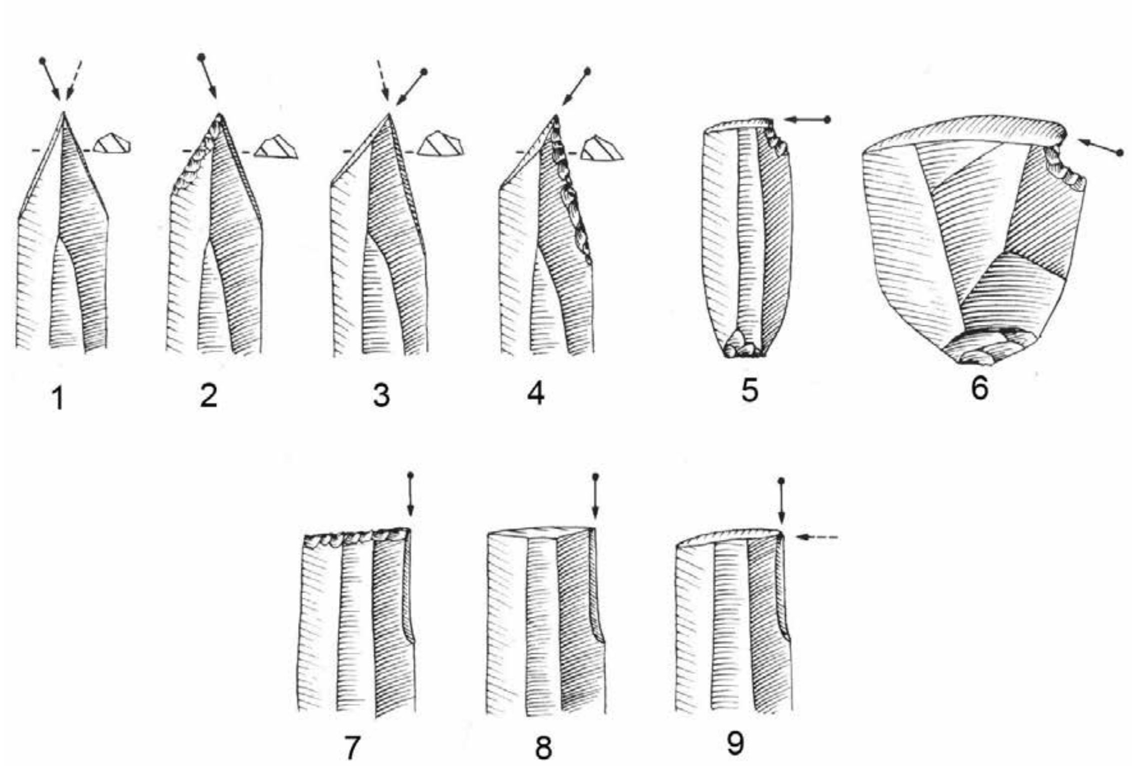


Fig. 4.22. Examples of simple (one removal) burins. Axis burins: 1 dihedral, 2 on truncation; *déjétes* burins: 3 dihedral, 4 on lateral retouch; transverse burins on notch: 5 on a blade, 6 on a flake; angle burins: 7 on truncation, 8 on transversal break, 9 on transversal burin facet (from Inizan *et al.* 1999, fig. 57).

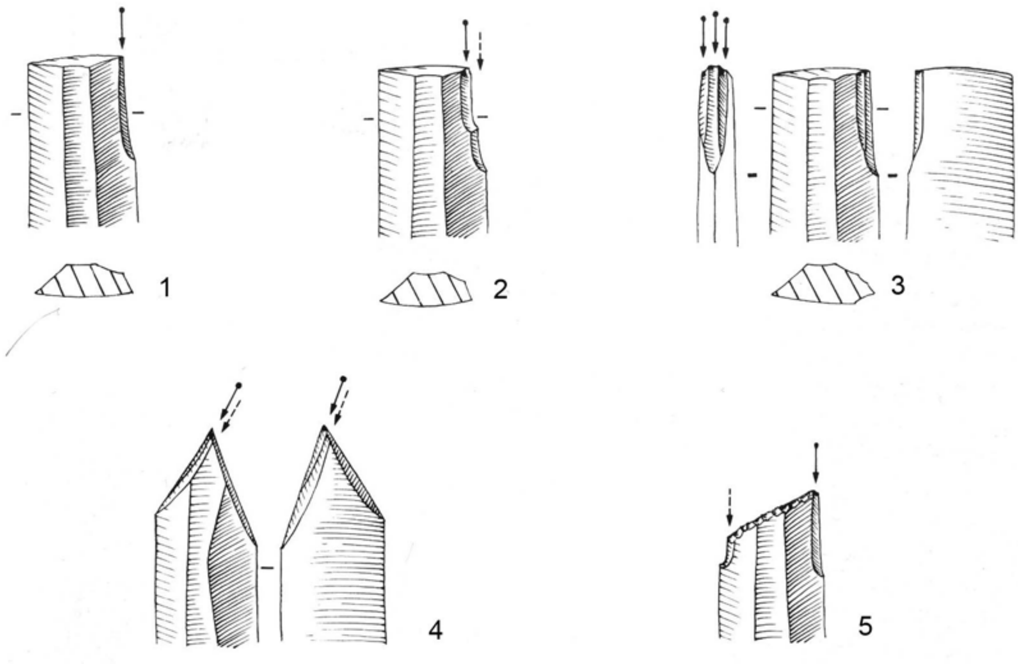


Fig. 4.23. Examples of sharpening on simple burins. 1: burin with a single burin facet, no visible sharpening; 2: sharpening by successive burin blows on the same point; 3: sharpening by parallel removals; 4: sharpening on both burin facets of a dihedral burin; 5: sharpening by truncation and application of a new burin blow on the opposite edge (from Inizan *et al.* 1999, fig. 79).

The use of this technique does not necessarily imply the manufacture of a tool. Indeed, if it can be shown that the production of blanks is intended, the burin is referred to as a core. The idea that burins must be equated with tools and spalls with waste products, is now outdated; burins and their spalls form a pair, whose use and purpose vary greatly.

Tranchets

The tranchet blow technique is most evident when applied to the cutting edge on one of the edges of triangular and elongated axe-shaped bifacials (or bifacially retouched pieces). This causes a flake to detach at an acute angle to the face. The negative of the flake removed creates a sharp cutting edge perpendicular to the axis of the artefact (Fig. 4.24).

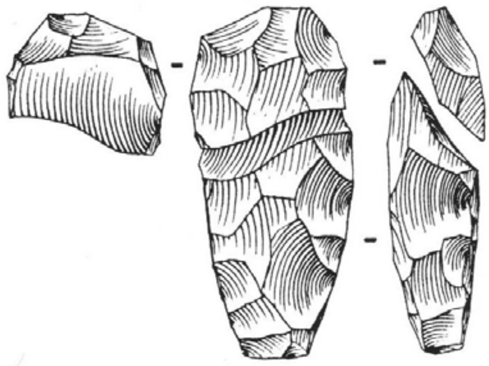


Fig. 4.24. Tranchet blow with resulting characteristic waste product (from Inizan *et al.* 1999, fig. 34, 1a).

Microburins

The microburin technique has been known since 1875 (Chierici 1875) and has been documented throughout prehistoric Europe. It is primarily employed in order to obtain a specific morphological trait called "*piquant-trièdre*" (Gobert 1955), often associated with the production of geometrical microliths (such as triangles, trapezes and crescents), but it is also employed in the manufacture of other tools. Experimental replication of this technique has successfully reproduced the sequence of actions involving a flake (or blade or bladelet) being placed on an anvil (Fig. 4.25), its upper face in contact with the ridge of the dihedral angle so that the axis of the blade or bladelet is diagonal to the ridge.

Clactonian notch

This is produced by means of striking a flake quite far from the edge and results in removing a thick chunk of striking platform (Fig. 4.26). Amongst other possibilities, this technique can be used to reshape the concavity of a carinated endscraper.

Thermal flaking

As previously discussed, the flaking qualities of flint can be improved by controlled heat treatment, especially when pressure flaking and retouching is carried out. Retouching undertaken after thermal treatment has been documented in the middle and late Neolithic (see Fig. 4.5).

Serial flaking

This technique is characterised by well executed, evenly spaced, regular parallel-sided scars. These appear to be obtained by means of pressure flaking, and may vary in their orientation, giving way to different morphological terms (e.g. ‘chevron patterned’). This technique has been associated with enhanced aesthetic value (Pape 1986).

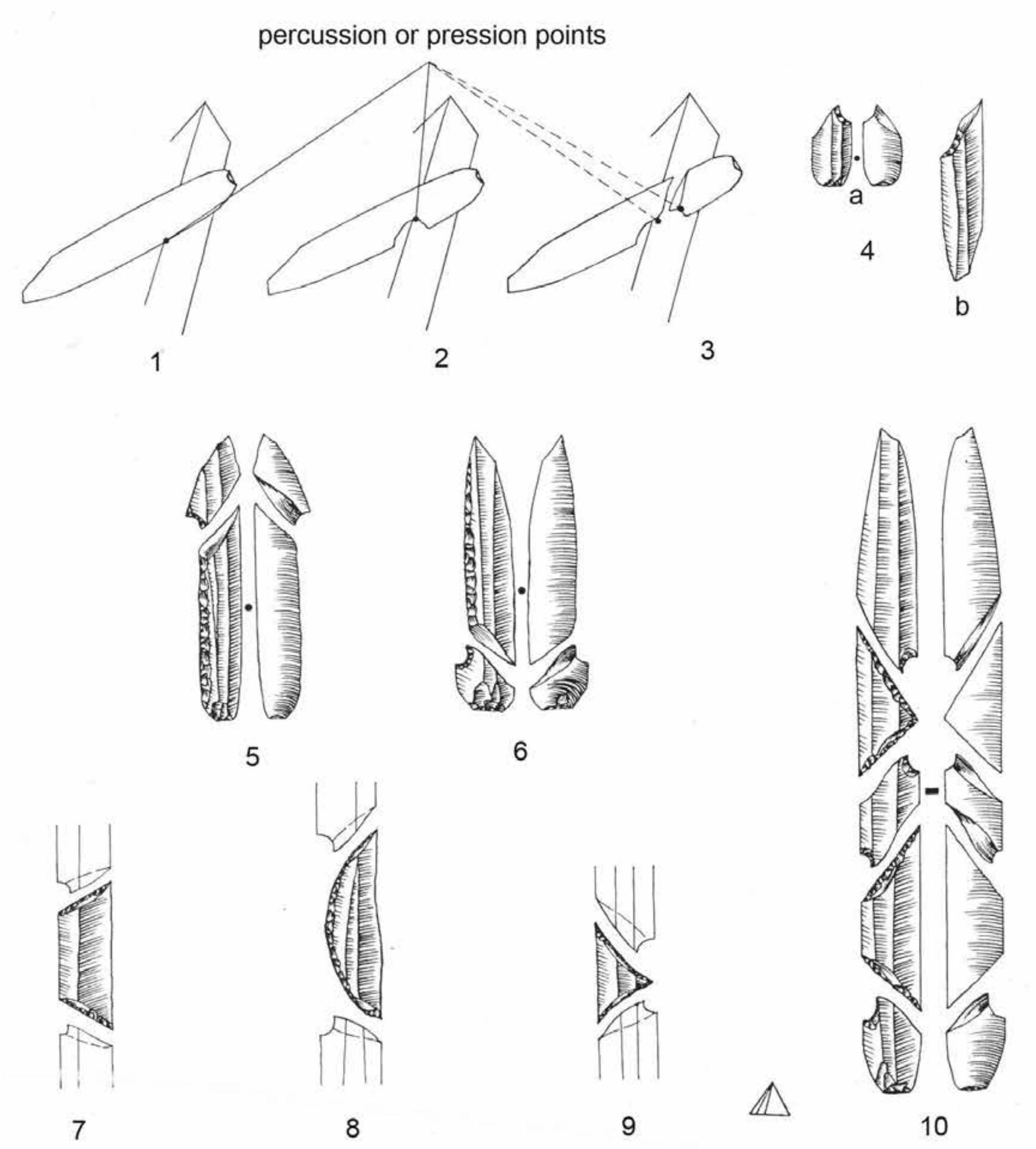


Fig. 4.25. Microburin blow technique. Production scheme of a microburin (4a) and a *piquant-triédre* (4b) by percussion or pressure on one edge of a blade resting on an anvil (1, 2, 3). Using this technique to obtain a backed blade with a distal (5) or proximal (6) *piquant-triédre*, a trapeze, a crescent or a triangle (7, 8, 9). 10: production of a triangle and a trapeze on the same blade; from top to bottom: distalmicroburin, triangle, double microburin, trapeze, proximal microburin (modified from Tixier *et al.* 1976, fig. 16 and Inizan *et al.* 1999, fig. 33).

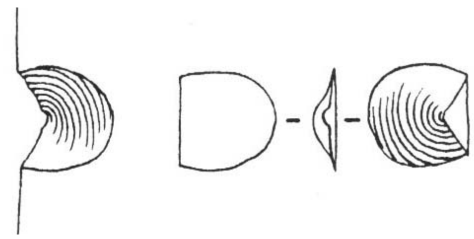


Fig. 4.26. Clactonian notch technique and waste product (from Inizan *et al.* 1999, fig. 34, 4).

Fig. 4.27. Examples of oblique parallel retouch covering both artefact surfaces. Left: obsidian (J. Tixier). Right: heat-treated Grand-Pressigny flint (D.E. Crabtree). (Atelier photo C.N.R.S. Meudon, reproduced in Inizan *et al*. 1999, fig. 71).

Organization of data: the creation of a database

In order to provide a reliable structure for analysis of the lithic assemblage from Rocca di Rivoli, it is necessary for the analyst to separate their hypotheses (*ideas*) from the flint artefacts under study (*phenomena*) (after Dunnell 1971: 26). This distinction is an artificial one, but at the same time a useful one since it separates the means of explanation from the explanation itself (Dunnell 1971: 27). Systematic organization of data resulting from the observation of flint artefacts from Rocca di Rivoli was undertaken with the help of a database, designed and built for the present study.

A database is a collection of data organized in such way that it can easily be accessed, managed and updated. The one created for the present study is a relational database: i.e. a tabular database in which data is defined so that it can be reorganized and accessed in a number of different ways. Relational databases represent relationships between data using primary and foreign keys rather than pointers. By so doing, search rather than navigation is emphasized. The principle underlying its creation is that of classification, involving the arbitrary definition of units or categories (classes) according to which information retrieved through observation is ordered.

Through classification archaeologists assign items, either real or imagined, to categories in a pre-arranged system (Banning 2000: 36). One or more rules define one category or class, and failure to comply with the set criteria results in exclusion from that class. The archaeologist's need for classification stems from the fact that every observed phenomenon, *latu sensu*, is unique: it has its own particular combination of values in an infinite number of characteristics or attributes. However, when trying to make sense of the archaeological record, either in terms of observed phenomena or in order to draw comparisons between different phenomena, information needs to be arranged in such a way as to become 'readable' and 'manageable'. *Sensu strictu*, classification is the "creation of units of meaning by stipulating redundancies (classes)" whereas grouping is "the creation of units of things (groups)" (after Dunnell 1971: 44).

Several attributes have been selected in order to serve as criteria enabling classification of flint artefacts from the middle Neolithic deposits of Rocca di Rivoli. Each database field might represent either a category (a set of criteria), or a criterion itself (e.g.presence or absence of a specific attribute). Precise definitions of each organizational unit (category, criteria, attribute) aim at limiting ambiguity during data collection and sorting, thus guaranteeing replicability. However, because of the nature of the phenomena archaeologists try to record as well as individual perception biasing observation, an alternative approach is that of defining "fuzzy" categories (Zadeh 1965).

Application of a fuzzy logic approach within the discipline of lithic studies has been limited and controversial, and mainly concentrated on confronting taken-for-granted typological classes and the degree of confidence in attributing them (e.g. Hermon & Nicolucci 2002), and on definition of use-wear patterns (e.g. Barcelo *et al*. 1996). The potential of this approach is both promising and revealing, but it was not chosen as an analytical tool for the present work because testing degrees of confidence was not one of the research objectives. At the same time, the employment of a non-fuzzy approach does not necessarily mean that the classification process during attribute recording was a problem-free exercise. Discrepancies persist between rigid categories and fuzzy phenomena. This introduces two fundamental issues deeply interconnected and related to the creation and use of any classification system: variability and errors.

Variability and Errors

Despite the fact that considerable attention has been focussed on the nature of lithic artefacts classification, especially as regards period-related typologies, there has been little discussion of the nature of classification processes from a theoretical, methodological or even practical point of view (Whittaker *et al*. 1998). Issues of subjectivity, consistency or variability have simply been brought to the attention of the archaeological community, followed by a list of good practice guidelines (e.g. Daniels 1972).

Bias in the recording of artefact attributes derives from a lack of accuracy which in turn can be introduced by inexplicit class definitions, differences among analysts' training or a single analyst's changing perceptions over time (Beck & Jones 1989). Bias may result, for instance, in systematically recorded higher or lower values in either ordinal or interval scales, or in repeated classification of artefacts in the wrong category of a nominal scale. For this reason, a series of measures have been put into place in order to minimize mistakes.

The first is a clear definition of categories, criteria and attributes. Difference in training and change of perception over time are unlikely to have affected the present study since recording was undertaken by myself only, and the vast majority (85%) of artefacts were recorded over a 12-month period. Nonetheless, as in any classification exercise, sooner or later during the collection of data, one encounters an attribute which is difficult to match confidently with a criterion. In such cases, an arbitrary and subjective decision needs to be taken. One of my main concerns, stemming from previous use of artefact classification databases, was also to avoid rigid hierarchisation of artefact classes (blades, flakes etc.) and the range of attributes associated with them by default.

An example best illustrates the problem. When compared to blades, knapping of flakes is generally held to receive less planned investment, in terms of choice of raw material type, shape and dimensions, but also as regards core preparation, especially core platform preparation evident in flake butt morphology and (to a lesser extent), overall flake morphology (in particular dorsal morphology). This series of assumptions (which are, however, valid for the majority of later prehistoric flint assemblages) is often translated into a narrower range of butt morphology attributes for flakes, which in turn leads either to arbitrary choices to ignore variability outside set categories, or descriptions long and difficult to manage in notes/comments fields.

For this reason, it became essential during the process of database design to minimise hierarchical relationships and leave freedom to move attributes about, as in the case of blades and flakes. I believe that attribute recording structured in this way offers the possibility to more easily notice variability in technological behaviour that might otherwise be lost because of current *a priori* assumptions in the field of lithic studies.

Errors and variability in any classification exercise are fundamental issues. At the same time, there is no one way to mitigate them, as there are no ways to precisely predict human error. Mathematical means to identify humanly introduced errors in classification processes are available to archaeologists (e.g. Banning 2000; Van Pool & Leonard 2011), although beyond the scope of the present work.

Conclusions

This chapter has laid out the rules according to which subsequent analysis will be carried out. The definition of attributes and categories is pivotal to the data collecting process, as is a suitable way of doing this effectively by means of a relational database. The methodology adopted here is only one of many possible ways to proceed in the study of knapped stone artefacts, but I believe it is the most effective for understanding the lithic technologies represented at Rocca di Rivoli.

The analytical approach adopted is founded on a series of ideas and theories which are both inspired by and strongly bound to the concept of *chaîne opératoire*, namely the conviction/belief that only a "total approach" (*sensu* Audouze 2002) to the study of prehistoric artefacts can lead to the understanding of prehistory in terms of social relations, practices and beliefs. Perhaps the most important principle of this approach is the view that an artefact is a product of human hands and thoughts, therefore it necessarily holds, within it, aspects of human interactions and beliefs. By shifting the attention from the artefacts to the "hands of the knapper" a series of questions arise that cannot be answered by an old-fashioned typological list of artefacts.

Linked to the *chaîne opératoire* approach, there is also a self-reflective/self-critical attitude which characterizes archaeology as a discipline, and which acknowledges the subjectivity of archaeological interpretation and the limitations of investigating the past whilst living in the present, with its practical as well as ideological constraints. Perhaps one of the more challenging aspects of the present work has been going back to artefacts which were excavated in Italy in the 1960s when excavation methodology was different from now and when some of the questions which I am asking had not yet found their way into archaeological discourse. Self-critical behaviour in archaeology includes the skills and attitudes of the individual undertaking research, and therefore both my training and experience in the field have undoubtedly influenced choices in methodological matters.

Last, but no less important, are the material constraints that have contributed to shape both methodology and subsequent analysis. Access to the material has been a problem throughout the whole duration of the present work. The impossibility to go back to the great majority of finds meant that a considerable amount of energy was put into designing ways of backing up information (e.g. by means of a photographic record) prior to undertaking analysis. In addition, the impossibility to look at the material in a sufficiently large space (e.g. in order to lay out all flint artefacts from one context on a table) surely limited the retrieval of potential information.

The factors listed here are not exceptional, but it is of paramount importance to take them into consideration during methodology design and whilst undertaking analytical work. The definitions of criteria adopted in the creation of attribute categories are intended to direct and inform both data collection and analysis. As part of a relational database they turn into a reference system, the main function of which remains to ‘measure’ artefact variability. At the same time, since artefacts are made, handled, used and discarded by the hands of human beings living amongst other human beings with an infinite range of practices, behaviours and beliefs, it is a part of past human life variables that we are trying to grasp by analysing flaked artefacts. Starting from the work undertaken on raw material outcrops identification and sampling, the next chapters will unfold the process by which the knappers of Rocca di Rivoli might come to life.

Chapter 5

RAW MATERIAL

Raw material exploitation has always represented an important economic aspect, often affecting settlement choices and production strategies of human groups since early Prehistory. The Jurassic and Cretaceous flint deposits of the so-called 'Venetian platform' (Lessini Mountains and Mount Baldo) north of Verona, have supplied good to excellent quality flint to prehistoric communities both locally and further afield at least from the middle Palaeolithic (e.g. Barfield 2011; Candelato *et al*. 2003).

This chapter introduces the topic of raw material, concentrating on the Lessini Mountains. Research into flint sources has focused on flint outcrops and deposits primarily located in this area, probably because evidence for flint exploitation is conspicuous as are traces of human settlement (surface finds, extraction and workshop sites etc.) (e.g. Barfield 1987, 1990; Chelidonio & Zanini 2007). However, Mount Baldo too, although less investigated, is also rich in flint outcrops and was another source of good quality flint.

Geological background

The Lessini Mountains comprise mainly sedimentary rocks of Jurassic, Cretaceous and Tertiary ages. Not all rock formations bear flint: *Dolomia* and *Calcari Grigi* do not hold any (Fig. 5.1). Flint bearing formations are, in stratigraphical order:

1. *Calcari di San Vigilio*. This formation contains flint levels up to 3m high. Flint is opaque and grainy. Characterised by the presence of oolites, discernable with a 10x magnification. Colour varies from pale greyish-brown to yellowish brown. Good quality.
2. *Rosso Ammonitico*. Flint from this formation is not very common. Opaque, with medium to grainy texture. Colour varies from dark red to reddish pink.
3. *Maiolica* (Figs. 5.2 and 5.3). Flint from the Maiolica formation is the most abundant on the Lessini Mountains. Its quality is far superior to the Jurassic varieties. This is a diaphanous, homogeneous and compact flint. It is characterised by the presence of white *flocculi* and white biosomata ghosts. Its colour is highly variable: white, honey-brown, greysh-green, pale yellow, yellowish grey, reddish brown, grey, dark grey.
4. *Scaglia Variegata* (Figs. 5.4 and 5.5). Presence of good to high quality flint in this formation is highly variable. Generally this is a diaphanous, homogeneous, and compact flint. However it can also present an opaque variety (dark grey and greenish grey). Its colour is highly variable: honey-brown, greyish-green, pale yellow, ochre, dark green,

yellowish grey, reddish brown, bluish black.

5. *Scaglia Rossa* (Fig. 5.6). This is present in a thin layer at the basis of the rock formation. Its quality is medium to good. It is opaque, not always homogenous and its colour varies from brick red to reddish pink, with a black and or yellowish-grey variety documented exclusively around Mt. Pastello (Isotta & Zanini 2008).
6. *Scaglia Eocenica* (throughout this work referred as Eocene) (Fig. 5.7). Flint from this formation occurs rarely but usually in very large blocks. Occasionally it may present white *flocculi*. Most often is diaphanous but it can be opaque (ibid.).

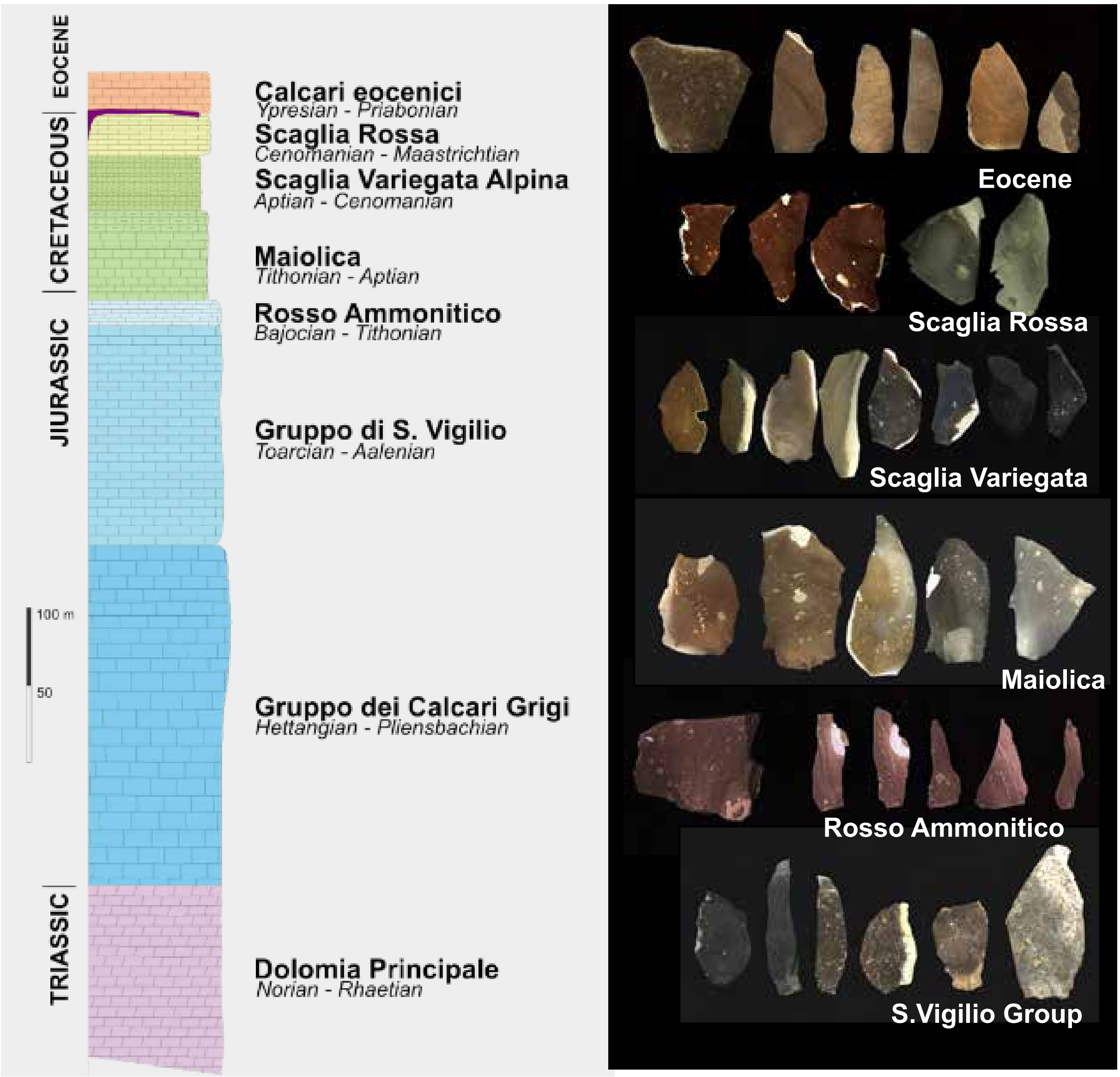


Fig. 5.1. Left: stratigraphical sequence of main geological formations in the Lessini Mountains. Right: examples of flint varieties from flint bearing geological formations. (left, from http://spotidoc.com/doc/730904/an-introduction-to-the-geology-of-the-lessini-mountains-area. Right: courtesy of Progetto S.E.L.C.E.).

Fig. 5.2. Flint types from the Maiolica formation (loc. Mount Crubbio) (from Isotta & Zanini 2008, fig. 2).

Fig. 5.3. Flint types from the Maiolica formation (loc. Orsara, Grezzana) (from Isotta & Zanini 2008, fig. 3).

Fig. 5.4. Flint types from the Scaglia Variegata formation (loc. Molina, Grezzana) (from Isotta & Zanini 2008, fig. 4).

Fig. 5.5. Flint types from the Scaglia Variegata formation (loc. Colombara Pellegrini Romagnano) (from Isotta & Zanini 2008, fig. 5).

Fig. 5.6. Flint types from the Scaglia Rossa formation (loc. Pesa di Romagnano) (from Isotta & Zanini 2008, fig. 6).

Fig. 5.7. Flint types from the Scaglia Eocenica formation (loc. Mount Loffa, Sant'Anna d'Alfaedo) (from Isotta & Zanini 2008, fig. 7).

Flint can be found in primary and secondary contexts. Primary outcrops are the original rock formations within which flint formed. These tend to be exposed hill flanks or cliffs but might also appear as horizontal levels, depending on the tectonic movements the geological formation underwent. Flint shows through as a line of different rock type and colour or in the form of isolated nodules (Figs. 5.8 and 5.9). Secondary deposits consist of geological formations resulting from the erosion of primary outcrops. Rocks are eroded by fluvial or glacier action, by weathering or karst activity with the result that over the millennia flint nodules or pebbles are found re-deposited away from where they originally formed, such as glacial moraines, alluvial fans, paleochannels. Rivers, gorges and streams are also flint repositories (Figs. 5.10 and 5.11). In addition, the Lessini Mountains present a peculiar secondary context called "*terra rossa*" (red soil). This is the result of karst activity on exposed Maiolica *plateaus*: water erodes the exposed limestone isolating the flint nodules that are found buried in red clay.

Fig. 5.8. Flint layer in exposed Maiolica rock formation (source: after http://spotidoc.com/doc/730904/an-introduction-to-the-geology-of-the-lessini-mountains-area).

Fig. 5.9. Flint nodule exposed in Scaglia Variegata rock formation (source: Author).

Fig. 5.10. Adige river at Rivoli Veronese, flint pebbles are found on the river beach (source: Author).

Fig. 5.11. Flint pebbles and nodule are found in streams (location: Cavazze) (source: Author).

Flint characterisation

Lessini Mountains lithotypes are characterised by high variability in terms of colour and texture. It can be difficult to recognise which flint comes from which rock formation at artefact level. Experience is key as is the knowledge of the flint bearing formations in the landscape, in order to readily compare artefact raw material characteristics with those recorded at the geological formation level. For the present study, flint type characterisation was carried out at a macroscopic and low power microscopic level (10x).

In addition, at the time of starting research for the present thesis, a flint characterisation project was under way in Verona at the Natural History Museum (Progetto S.E.L.C.E.; Candelato *et al*. 2003) and I could benefit of data collected during fieldwork (which to date remain unpublished) to familiarize myself with the different flint varieties. A series of thin sections for chemical and petrologic analysis were carried out on a sample of flint types collected by the Project throughout key locations on the Lessini Mountains. Unfortunately the chemical analysis did not produce any relevant results. Rather, it confirmed, Cremaschi's thesis (1981) that a precise characterisation of a piece of flint is not possible, since all flint belonging to the same geological formation have the same chemical composition, regardless of other variables (outcrop location, altitude, particular mineral sources nearby etc.). Therefore, a flint nodule extracted from a cliff at 1km from Rocca di Rivoli will have the same chemical characteristics of a flint coming from the same formation located 30km further east into the Lessini Mountains.

For the time being, there is no way round this problem and the traditional method of sampling flint outcrops and deposits around the site remains a valuable resource for obtaining comparative material. In order to get to grips with inter and intra-formational flint variety and to try to understand where the raw material employed at Rocca di Rivoli could have possibly come from, fieldwork was undertaken with the following objectives in mind:

1. Sampling flint outcrops to create a reference collection from available flint types;
2. Integrating available geological maps with detailed information coming from survey (e.g. at present geological maps indicate Maiolica and Scaglia Variegata as one and the same rock formation).
3. Checking whether formations indicated on the map do include flint.
4. Assessing flint quality when found through experimental activity (test knapping).

Starting from the geological cartography available, I proceeded to survey the landscape around Rocca di Rivoli, recording flint outcrops and taking samples of them. Figure 5.12 shows the area and locations explored around Rocca di Rivoli. The data collected were added to the already existing S.E.L.C.E. database, but unfortunately this became unavailable in 2009.

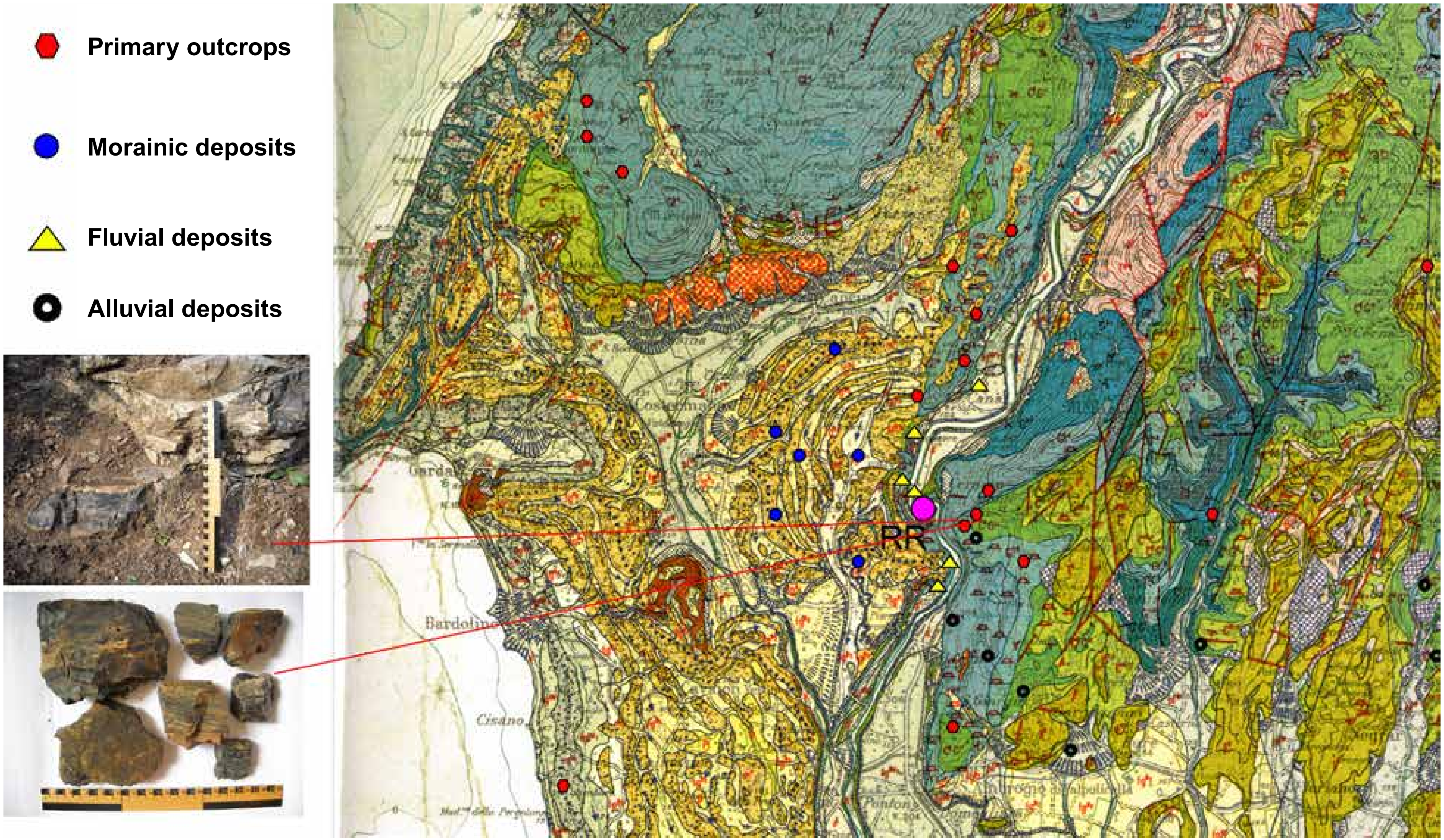


Fig. 5.12. Distribution of flint locations around Rocca di Rivoli sampled for the present work (source: Author – Scale, metric system, 1:100,000).

Results of fieldwork undertaken identified a series of good flint locations in the immediate vicinity of Rocca di Rivoli (1 to 3 km). For the majority these are secondary deposits, mainly fluvial deposits and alluvial fans. Morainic deposits were extensively investigated but unfortunately these did not produce any flint, although modern day flint knappers reported that flint, although not so common, is found there (Claudio Isotta, pers.comm. 2010).

Further north and east (3 to 8 km) primary outcrops of Maiolica and Scaglia Variegata types are also to be found. These are of superior quality when compared to flint collected by the river Adige and in streams and gullies up the hills. No "*terra rossa*" deposits were recorded in the vicinity of Rocca di Rivoli. The only ones recorded to date are those located in proximity of the Ponte di Veja, where exploitation was documented through archaeological survey and subsequent excavation in the 1980s (Barfield & Chelidonio 1992-1993).

On the basis of the data collected during fieldwork six types of raw material were identified in the assemblage of Rocca di Rivoli. These are commonly referred to with the name of the geological formation they come from: Maiolica, Scaglia Variegata, Scaglia Rossa, Oolitico di San Vigilio, Rosso Ammonitico and Eocene (see Chapter 4, Table 4.13 for the nominal scale and corresponding lithotypes categories employed in the database and subsequent analysis).

Fieldwork was instrumental not only to get to grips with different flint varieties (fracture mechanics, colour, fossils and other types of inclusions) but also to single out different types of characteristics to identify whether raw material (nodule, pebbles and blocks) was coming from primary or secondary sources. 5 different types of parent material were identified:

1. Pebbles from glacio-fluvial secondary deposits. These are usually round or sub-round in shape and bear traces on their cortex of river rolling (fissures) or are smoothed out by water erosion.
2. Pebbles or nodule from unspecified secondary deposits. Sub-round or sub-angular in shape, come from alluvial fans and other detritus accumulation usually at the bottom of hills. Their cortex is highly variable but easily set apart from that of raw material coming from glacio-fluvial deposits.
3. Pebbles or nodules from "*terra rossa*" deposits. These types of nodules are usually of larger dimensions than those coming from other secondary deposits. They are sub-round in shape and present the characteristic red stained cortex, which sometimes survives even deliberate abrasion of its outer surface.
4. Nodules from primary outcrops are sub-round and sub-angular in shape. Cortex from primary outcrops was found to often be a powdery and thinner.
5. Blocks from primary outcrops. These are usually angular and sub-angular in shape as they are extracted directly by the strip-like flint level contained in between the limestone formation. Cortex is powdery and at times very thin.

Unfortunately the recognition of parent material type through the observation of cortex on excavated artefacts posed a few problems. First of all, the portion of cortex surviving on knapped artefacts is very small. Exception might be when the artefact being analysed is a core. However, as we will see further on, the majority of cores from Rocca di Rivoli entered the archaeological record after having undergone intense exploitation which means that a very tiny percentage of cortex, if any, survived. Secondly, artefacts may undergo transformations such as cortex removal or abrasion at the hands of the knapper. Thermal alteration is also responsible for deleting potential information. Finally, poor conservation and handling might also contribute to compromise the aspect of surviving cortex on flint artefacts.

Raw material procurement

Lithic raw material availability has been held to be a key factor in the organization of technology. Whereas some studies (e.g. Andrefsky 1991; Henry 1989) showed that amount of effort expended in tool production tends to correlate with type of settlement strategy, the ethnographic literature suggests that the availability of lithic raw material plays a primary role in the amount of effort employed to produce various types of tools (e.g. O'Connell 1977; Gould 1980).

Archaeological evidence of occupation of the Lessini Mountains sees a steep increase during the VBQ II and III periods and continues well into the Calcolithic period when settlements start appearing further into the mountain range in proximity of flint outcrops (Barfield 1990). Barfield (1994) suggested four different scenarios for Lessini flint circulation from the early Neolithic through to the middle Bronze Age (Fig. 5.13). Barfield (ibid.) provides details on how procurement took place for the Calcolithic and Bronze Age at Ponte di Veja (5.14). On the basis of his research and available literature (e.g. Barfield 1990; Pessina & Tiné 2008; Mottes 2000) it is possible to tentatively outline three different models of Alpine flint procurement in the Lessini Mountains:

1. During the early Neolithic, settlements are situated in proximity of flint sources (e.g. Lugo di Grezzana). Production is already geared toward exchange as it is suggested by Alpine flint finds excavated in a number of Po Plain early Neolithic settlement sites.
2. With the middle and late Neolithic, settlement sites increase considerably in and around the Lessini Mountains. There is no direct evidence of mining or quarrying associated to this period, but surface finds in a few locations (e.g. Passo del Piccon, Ceredo) identify areas of flint procurement. Po Plain settlement sites continue to receive high quality Alpine flint.
3. From the Calcolithic through to the middle Bronze Age, evidence of mining and quarrying (e.g. Ponte di Veja) suggests organized exploitation. Workshops have been excavated and typical quarry-side flint production identified (Barfield 1990, 1994). Exchange routes intensify and Alpine flint from the Lessini Mountains is found in settlements further west and south.

More information is needed at the moment, to further investigate how exploitation of the flint resources naturally available in the Lessini Mountains took place during the middle and late Neolithic and further detail the scenarios proposed above. Data collected from the Rocca di Rivoli assemblage might disclose additional details in order to understand this crucial initial stage as part of hypothetical *chaînes opératoires*.

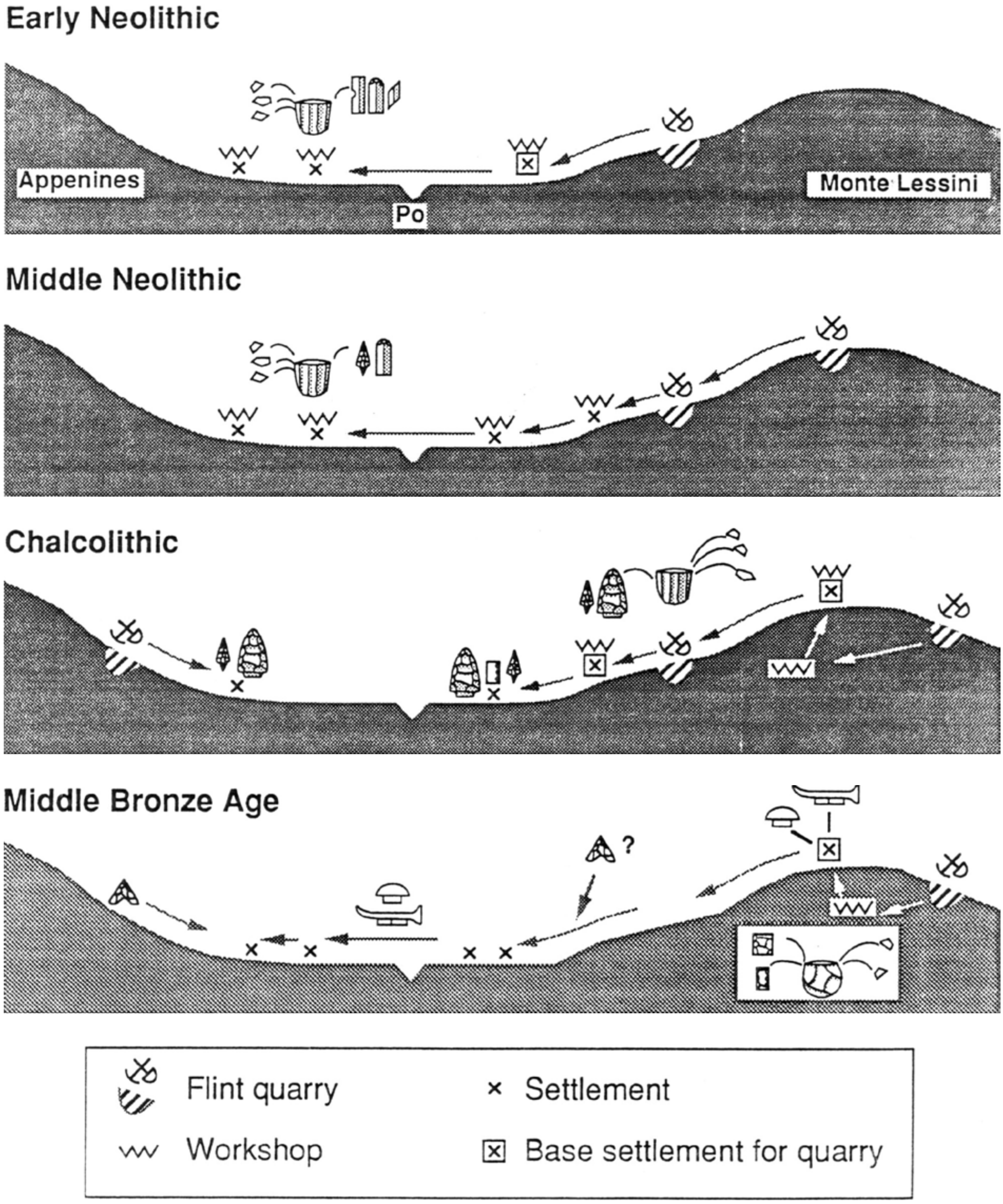


Fig. 5.13. Schematic representation of flint traffic in a transect from the Lessini Mountains across the Po Plain suggested by L.H.Barfield (from Barfield 1994, fig. 7).

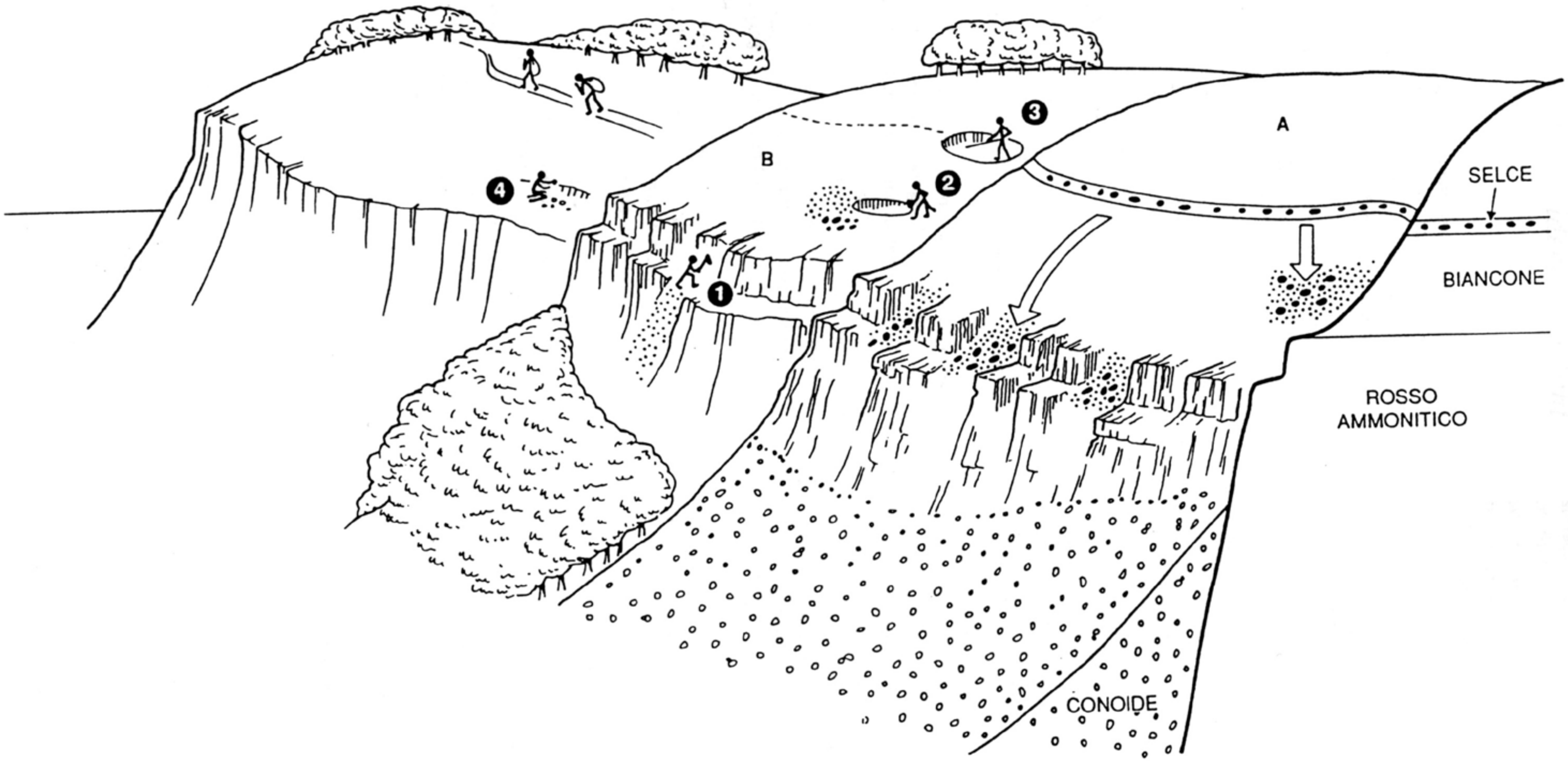


Fig. 5.14. Schematic representation of mining activity of terra rossa deposits during the Calcolithic and Bronze Age at the Ponte di Veja. A: formation processes of secondary flint deposition. B: Human activities; 1: Quarrying nodules from terra rossa in fissures in the Jurassic rock. 2: Quarrying secondary nodules from terra rossa in a side valley. 3: Direct quarrying from the Maiolica rock formation. 4: flintknapping workshop area. (from Barfield & Chelidonio 1992-1993).

Chapter 6

THE LITHIC ASSEMBLAGE FROM ROCCA DI RIVOLI

Introduction

This chapter provides a general idea of the type of assemblage the Rocca di Rivoli material represents in terms of quantification (numerical quantities and weight), artefact type composition, raw material type, archaeological phasing and degree of preservation. It precedes three chapters concerned with the analysis and subsequent discussion of *chaîne opératoire* operational stages:

1. Raw material procurement;
2. Initial flaking and core reduction;
3. Blank selection and retouching followed by discard.

The collected data will be presented and discussed in relation to three broad analytical categories: cores, debitage (flakes, blades, debris) and retouched artefacts (retouched flakes and blades). In addition, there may be the need from time to time to pick up, more closely, patterns emerging for a specific artefact type. In doing so, the principal focus remains to answer the main questions set out at the start of this thesis (Chapter 1).

Wherever feasible both numerical quantity and weight are analysed in order to gain a better understanding of assemblage size and nature. Table 6.1 shows the overall quantity of artefacts (including fragments) subdivided into the three broad categories (cores, debitage, retouched artefacts).

Pits	Flakes	Blades	Debris	Debitage Total	Retouched Flakes	Retouched Blades	Retouched Total	Cores	TOTAL
L	29	4	17	50	0	3	3	0	53
subtot. Chiozza phase	*29*	*4*	*17*	*50*	*0*	*3*	*3*	*0*	*53*
A	106	20	109	235	10	4	14	1	250
J	214	128	114	456	43	24	67	19	542
K	258	110	137	505	41	28	69	9	583
L	308	65	182	555	65	15	80	19	654
M	49	22	23	94	4	2	6	2	102
N	46	10	17	73	9	3	12	1	86
O	276	68	82	426	40	27	67	17	510
PQR	716	252	332	1300	186	62	248	32	1580
S	145	52	72	269	27	15	42	8	319
T	20	7	6	33	9	0	9	2	44
U	97	39	53	189	32	8	40	4	233
V	557	135	241	933	86	28	114	23	1070
W	420	88	152	660	94	27	121	12	793
Z	14	5	2	21	12	7	19	14	54
subtot.Rivoli Castelnuovo I phase	*3226*	*1001*	*1522*	*5749*	*658*	*250*	*908*	*163*	*6820*
D	186	93	94	373	62	27	89	9	471
G	291	115	381	787	102	54	156	13	956
subtot. Rivoli Castelnuovo II phase	*477*	*208*	*475*	*1160*	*164*	*81*	*245*	*22*	*1427*
TOTAL	**3732**	**1213**	**2014**	**6959**	**822**	**334**	**1156**	**185**	**8300**

Table 6.1. Breakdown of the sampled lithic assemblage from Rocca di Rivoli subdivided per artefact category and pit context (quantities).

In total, 3929 out of 8300 artefacts are fragmented (47.34%), weighing 13,252.3g (38.98%). These figures take into consideration all debris which are by definition fragments. If we are to consider the latter separately, percentages are lower: 23.07% (numerical quantity) and 17.20% (weight). It is difficult to assess the role of fragmentation at Rocca di Rivoli since fragmented artefacts are usually not included in most lithic analysis, and therefore there are no means for comparison. At the same time, even though this data comes from a selected sample, it might be indicative of taphonomical processes or human behaviour at the site. In general, one would expect fragmentation to be rather high at a site like Rocca di Rivoli, where sampled lithics come from secondary deposition (*sensu* Schiffer 1976: 14) represented by acts of internment in pits.

A clearer idea of the nature of the assemblage can be gauged when looking closely at Figure 6.1, representing percentages of artefact categories according to their numerical quantities and their weight respectively. When considering numerical quantities, debitage (with the inclusion of debris) is by far the largest artefact group representing 84% of the total assemblage. Weight-wise, debitage is still the largest category, though core weight changes proportions considerably.

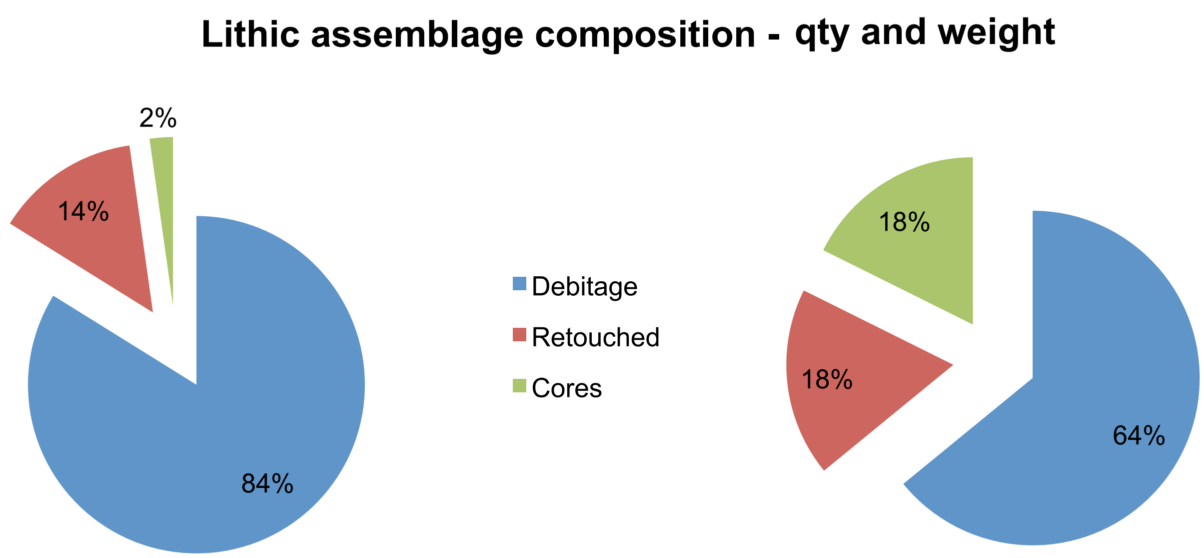


Fig. 6.1. Distribution of artefact types within the sampled lithic assemblage at Rocca di Rivoli (numerical quantities to the left and weight to the right).

Table 6.2 displays numerical quantities as well as percentages of individual pit quantities. The last column on the right shows an approximate calculation of the volume of each pit. Table 6.3 presents the distribution of artefacts according to archaeological phases. The greatest quantity of artefacts comes from pits attributed to the Rivoli Castelnuovo I phase, followed at some distance by Rivoli Castelnuovo II. Rivoli Chiozza is represented only by scanty remains which have been quantified despite holding little statistical value for the present study (Fig. 6.3). Some pits received more material than others. Certainly size matters, in as far as larger pits are suitable to receive larger quantities of debitage. However, it is not possible to estimate

Pit	Qty	%	Vol. m3
A	250	3	0.69
D	471	6	0.16
G	956	12	1.21
J	544	7	0.63
K	583	7	0.25
L	705	8	1.06
M	102	1	0.02
N	86	1	0.07
O	508	6	0.11
PQR	1582	19	0.57
S	319	4	0.34
T	44	1	0.06
U	233	3	0.18
V	1070	13	0.52
W	793	10	0.23
Z	54	1	0.13
Total	*8300*	*100*	*6.24*

how much material was not collected during excavation, or how much more material would have survived from a given context if poor conservation episodes had not taken place. For the time being therefore, it makes sense to look at individual pit contents through Table 3.4 (on p. 71), since the latter gives an idea of those contexts which were not matched during preliminary pit deposit identification, either because they were not there or because their identification was compromised.

Table 6.2. Lithic assemblage distribution per pit at Rocca di Rivoli with pit volume (numerical quantities).

Pits	Flakes	Blades	Debris	Debitage Total	Retouched Flakes	Retouched Blades	Retouched Total	Cores	TOTAL
L	173.1	26.1	125.4	324.6	0.0	19.7	19.7	0.0	344.3
subtot. Chiozza Phase	*173.1*	*26.1*	*125.4*	*324.6*	*0.0*	*19.7*	*19.7*	*0.0*	*344.3*
A	246.4	32.5	308.4	587.3	61.7	4.1	65.8	89.0	742.1
J	772.9	297.0	372.3	1442.2	270.1	93.7	363.8	734.5	2540.5
K	765.2	174.2	376.5	1315.9	279.0	73.9	352.9	286.8	1955.6
L	1235.8	124.3	785.4	2145.5	370.9	89.2	460.1	802.5	3408.1
M	118.5	29.6	94.9	243.0	25.2	2.9	28.1	68.5	339.6
N	127.8	14.6	37.8	180.2	67.8	6.4	74.2	15.5	269.9
O	801.3	130.4	296.9	1228.6	196.1	117.1	313.2	480.7	2022.5
PQR	2278.8	508.4	1268.5	4055.7	1117.7	246.2	1363.9	920.8	6340.4
S	495.1	148.6	378.7	1022.4	164.9	51.9	216.8	235.3	1474.5
T	82.1	13.9	29.3	125.3	76.5	0.0	76.5	61.3	263.1
U	339.1	62.3	266.5	667.9	157.0	24.0	181.0	87.7	936.6
V	1767.0	263.7	1158.9	3189.6	591.5	77.6	669.1	681.6	4540.3
W	1095.5	170.2	518.9	1784.6	493.8	83.8	577.6	370.8	2733.0
Z	39.8	34.9	60.8	135.5	138.1	34.4	172.5	609.0	917.0
subtot. Rivoli Castelnuovo I phase	*10165.3*	*2004.6*	*5953.8*	*18123.7*	*4010.3*	*905.2*	*4915.5*	*5444.0*	*28483.2*
D	562.9	122.5	250.5	935.9	351.7	97.6	449.3	211.5	1596.7
G	1138.4	190.3	1076.7	2405.4	613.3	202.8	816.1	350.6	3572.1
subtot. Rivoli Castelnuovo II phase	*1701.3*	*312.8*	*1327.2*	*3341.3*	*965.0*	*300.4*	*1265.4*	*562.1*	*5168.8*
TOTAL	**12039.7**	**2343.5**	**7406.4**	**21789.6**	**4975.3**	**1225.3**	**6200.6**	**6006.1**	**33996.3**

Table 6.3. Breakdown of the sampled lithic assemblage from Rocca di Rivoli subdivided by artefact category and pit context (weight - grams).

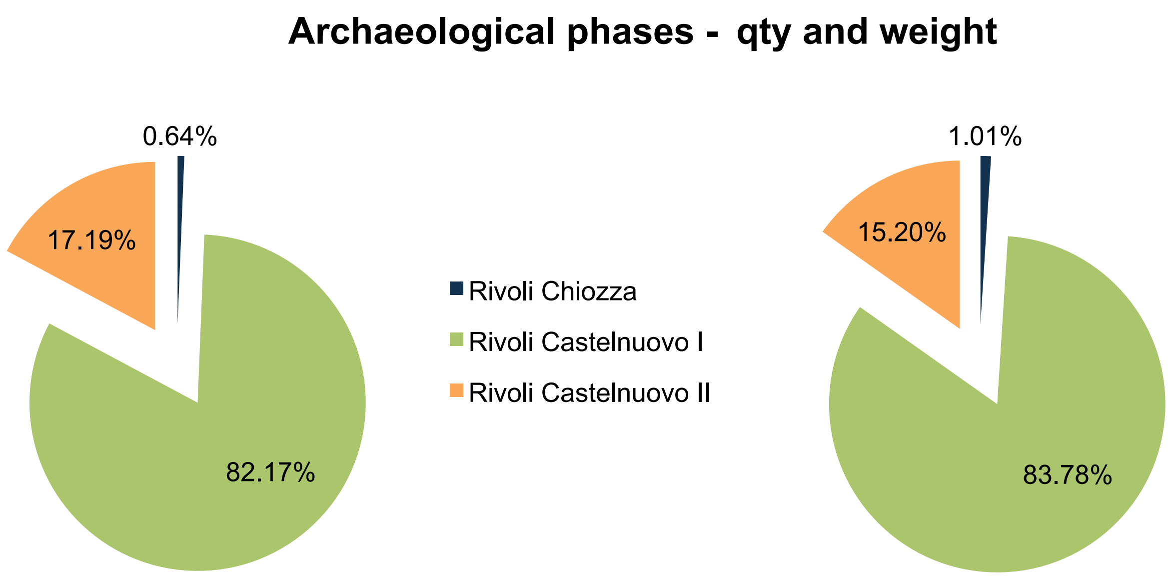


Fig. 6.2. Artefact distribution according to their associated archaeological phase (% values). Left: quantity. Right: weight.

Cores

Each core represents a unique process; one (or more) individual's sequence of thought-out, intentional actions: one *chaîne opératoire* situated in a specific space and time. Cores unearthed at Rocca di Rivoli provide us with a snapshot of the more articulated knapping process(es).

A total of 185 cores were analysed for the present study, together with 105 debris identified as core shatters, i.e. fragments of cores which, because of their small dimensions and damaged condition (e.g. burnt) failed to display those diagnostic traits (such as a debitage surface or striking platform) necessary to be recorded as cores or core fragments. At the same time it is clear that, because of still detectable portions of striking platforms and debitage surfaces, they were once part of cores.

The 185 cores weigh a total of 6,006.1g, i.e. approximately 18% of the total sampled assemblage weight. When looking closer at the data collected, mean core weight is 32.5g, whereas the median is 24.2g. Weight values display a high degree of variability, with the heaviest core weighting 352.4g and the lightest weighing 2.8g. Standard deviation from the mean is of 31.5g. This latter figure represents the average distance from any point in the data set to the centre (i.e. the average in this case) and confirms the degree of variability within the assemblage (Fig. 6.3).

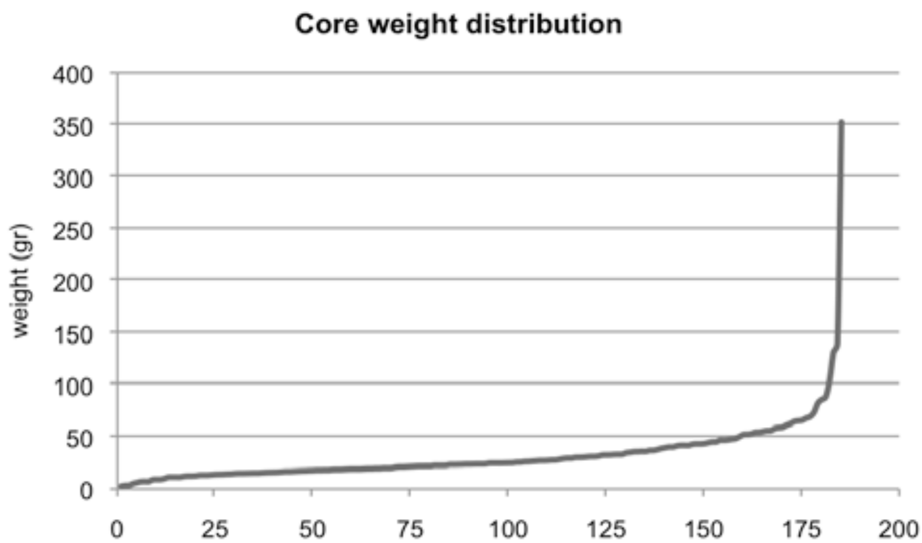


Fig. 6.3. Curve describing core weight distribution.

A closer look at the nature of the core assemblage points out that the majority of cores weigh between 2.8 and 40g. The weight interval holding the highest number of cores is that between 10 and 20g with 56 cores, followed by the one between 20 and 30g with 49 cores. Only one core weighs more than 150g (i.e. the outlier already mentioned above) and a mere 2% of the entire assemblage is represented by cores weighting 100g or more (Table 6.4).

Weight interval (gr)	Qty	Weight interval (gr)	Qty	Weight interval (gr)	Qty	Weight interval (gr)	Qty
> 0 and ≤ 10	11	>40 and ≤ 50	18	>80 and ≤ 90	3	120 and ≤ 130	0
>10 and ≤ 20	56	>50 and ≤ 60	12	>90 and ≤ 100	0	130 and ≤ 140	1
>20 and ≤ 30	49	>60 and ≤ 70	7	>100 and ≤ 110	1	140 and ≤ 150	1
>30 and ≤ 40	24	>70 and ≤ 80	1	110 and ≤ 120	0	> 150	1
Tot.	**140**	**Tot.**	**38**	**Tot.**	**4**	**Tot.**	**3**

Table 6.4. Core assemblage subdivided by weight intervals of 10g.

Figure 6.4 adds further detail to data displayed in Table 6.4 by clarifying the relationship between cores and flake cores. Because of the rather high variability displayed by weight values (with a standard deviation of 31.5g, see above), a count of individual cores is often accompanied by quantification based on weight, since the latter gives a better idea of the overall volume of raw material employed and it is directly linked to core size. Although it makes sense to expect flake cores to weigh, on average, less than cores, this is not always the case. Different factors contribute to core reduction and exhaustion. At Rocca di Rivoli, however, average weight of cores is approximately 36g (standard deviation: 36g), whereas average weight of flake cores is 24g (standard deviation: 13g).

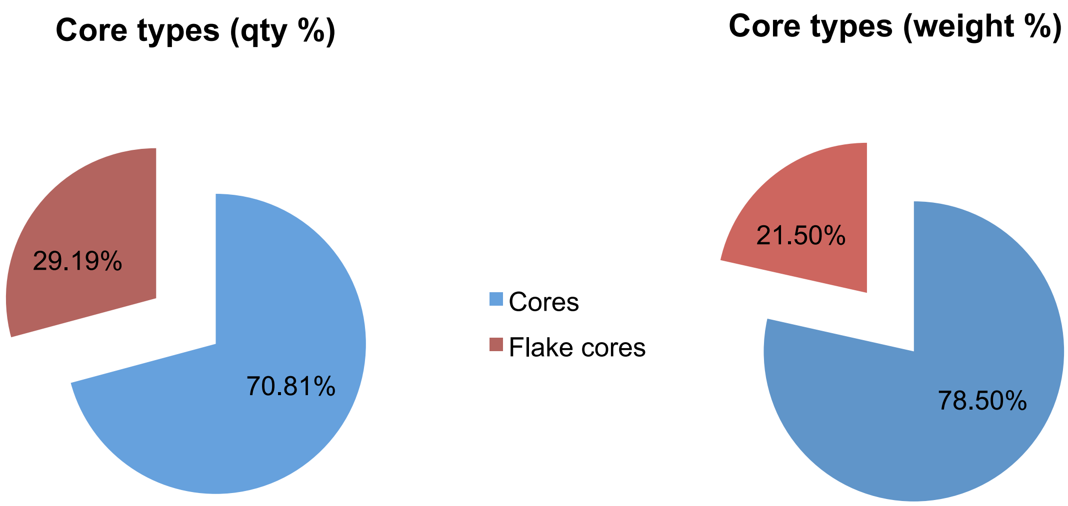


Fig. 6.4. Core types percentage values (numerical quantities and weight).

From the excavation records and the 1976 publication it was clear that the most intensive activity at the site coincided with the Rivoli Castelnuovo I phase. This produced the majority of features and finds and it is therefore no surprise to see that the majority of pits are associated with this occupation stage, nor that the majority of cores are attributed to this period (a total of 163 weighing 5,444.0g). The Rivoli Chiozza stage of occupation is represented by a very small percentage of finds but no cores. The Rivoli Castelnuovo II phase produced a very few cores (22 weighing 562.1g). This aspect shall be taken into due consideration during analysis and even more so during subsequent interpretation.

When looking at the distribution of cores among pits (Fig. 6.5), the group formed by pits PQR is the one producing the higher number of cores. This reflects the decision to group artefacts from these three pits (see Chapter 4). Smaller or shallower pits tend to produce fewer artefacts, in the same way as partially excavated features. At the same time, sample biases are also likely to project patterns that have nothing to do with archaeological variables, especially in terms of quantification.

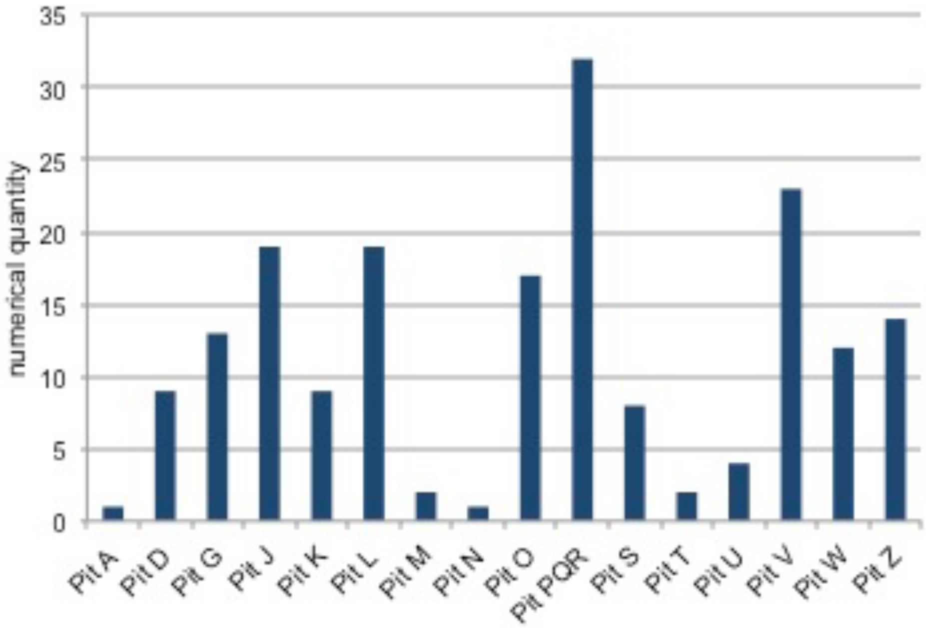


Fig. 6.5.: Distribution of cores by selected pit contexts (numerical quantity).

Debitage

Information previously obtained from the analysis of cores needs to be integrated with that coming from the debitage, i.e. unretouched blades and flakes. As anticipated in Chapter 4, debitage attributes have the potential of revealing significant insights into raw material procurement behaviour, knapping techniques, knappers' skills and traditions. This section will explore debitage and debris separately.

A total of 4945 unretouched blades and flakes were analysed for the present study. Into this category fall all knapped artefacts which:

1. Are not cores;
2. Do not present any intentional retouch along their edges or on their surfaces;
3. Present sufficient diagnostic traits (dorsal scar(s), bulb of percussion, striking platform) that prevent them from being classified as debris.

Unretouched blades and flakes represent a total of 14,383.2g i.e. approximately 42.30% of the total sampled assemblage weight. However, fragmentation plays an important role within the debitage category. Table 6.5 presents numerical quantities and weights of all debitage pieces according to their degree of completeness. Approximately 28% of the total debitage assemblage (roughly 1 in 5 pieces) is fragmented.

Artefact edges were also observed and their attributes recorded. Tables 6.6 and 6.7 display data relating to blades and flakes respectively.

Fragmentation	**Qty**	**%**	**Weight (gr.)**	**%**
Complete	3543	71.65%	11295.00	78.53%
Distal	506	10.23%	1173.20	8.16%
Proximal	546	11.04%	1153.20	8.02%
Fragment	350	7.08%	761.80	5.30%
Total	***4945***	***100.00%***	***14383.2***	***100.00%***

Table 6.5. Fragmentation of debitage pieces.

Edge Condition	**Qty**	**%**	**Weight (gr.)**	**%**
Intact	423	62.9%	955.8	57.1%
Damaged	39	5.8%	137.3	8.2%
Possibly utilized	211	31.4%	581.4	34.7%
Total	*673*	*100.0%*	*1674.5*	*100.0%*

Table 6.6. Edge condition of complete debitage blades.

Edge Condition	**Qty**	**%**	**Weight (gr.)**	**%**
Intact	1905	66.4%	5984.7	62.2%
Damaged	291	10.1%	887.2	9.2%
Possibly utilized	674	23.5%	2748.6	28.6%
Total	*2870*	*100.0%*	*9620.5*	*100.0%*

Table 6.7. Edge condition of complete debitage flakes.

Despite the fact that fragments have been included in some of the analytical processes further on, analysis of weight data took into consideration only complete artefacts. When looking closer at the data collected, average debitage weight is 3.2g, whereas the median is 2g. Weight values display some degree of variability, with the heaviest debitage piece being 56g and the lightest weighting 0.1g. Standard deviation from the mean is 3.9g. This latter figure points to the degree of variability within the assemblage (Fig. 6.6). There are only two values which distance themselves remarkably from the rest: respectively ID 4428 with 56g and ID 4058 with 45g. Both are exceptionally large and thick flakes that derived from the very early stage of core *mise-en-forme*.

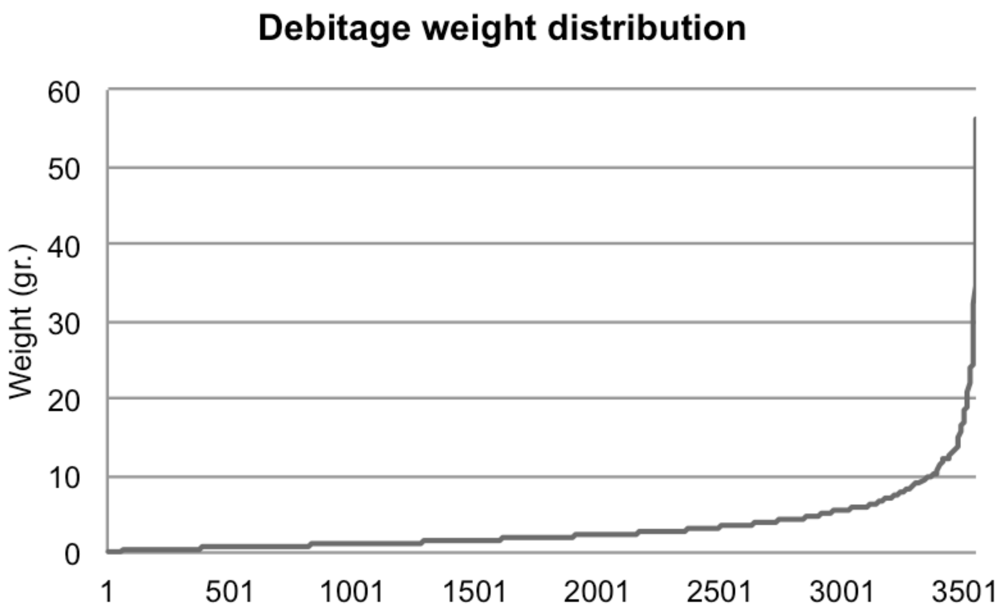


Fig. 6.6. Curve describing complete debitage weight distribution.

A closer look at the nature of the debitage assemblage shows that most pieces weigh between 0.1 and 5g. The weight interval holding the highest number of complete debitage pieces is that between 1 and 5g with 1987 unretouched artefacts, followed by the one between 0.1 and 1g with 946. Only 9 debitage pieces weigh more than 30g (Table 6.6).

Weigth values (gr.)	Blades	Flakes
Average	2.5	3.3
Max value	34.7	56.1
Min value	0.1	0.1
Median	1.4	2.1
Standard Dev.	3.5	4.0
Tot. Weight	1819.9	9475.1

Table 6.8. Comparison of weight values between complete blades and flakes.

Weight interval (gr.)	Qty	%	Weight interval (gr.)	Qty	%
≤ 0.1 ≤ 1	946	26.70%	> 10 ≤ 20	147	4.15%
> 1 ≤ 5	1987	56.08%	> 20 ≤ 30	26	0.73%
> 5 ≤ 10	428	12.08%	> 30	9	0.25%
Total	***3361***	***94.86%***		***182***	***5.14%***

Table 6.9. Debitage assemblage (complete artefacts) subdivided by weight intervals.

Weight interval (gr.)	Qty	%	Weight interval (gr.)	Qty	%
≤ 0.1 ≤ 1	245	34.31%	> 10 ≤ 20	17	2.38%
> 1 ≤ 5	385	53.92%	> 20 ≤ 30	5	0.70%
> 5 ≤ 10	60	8.40%	> 30	2	0.28%
Total	***690***	***96.64%***		***24***	***3.36%***

Table 6.10. Complete blades weight distribution according to weight intervals.

Weight interval (gr.)	Qty	%	Weight interval (gr.)	Qty	%
≤ 0.1 ≤ 1	701	24.78%	> 10 ≤ 20	130	4.60%
> 1 ≤ 5	1602	56.63%	> 20 ≤ 30	21	0.74%
> 5 ≤ 10	368	13.01%	> 30	7	0.25%
Total	***2671***	***94.41%***		***158***	***5.59%***

Table 6.11. Complete flakes weight distribution according to weight intervals.

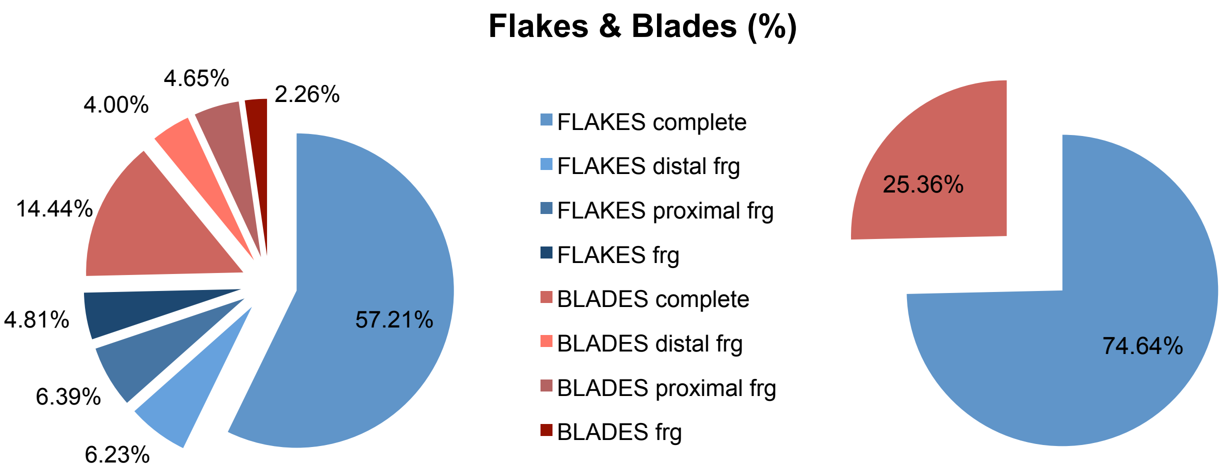


Fig. 6.7. Debitage assemblage subdivided by flakes and blades and their fragmentary pieces (numerical quantities).

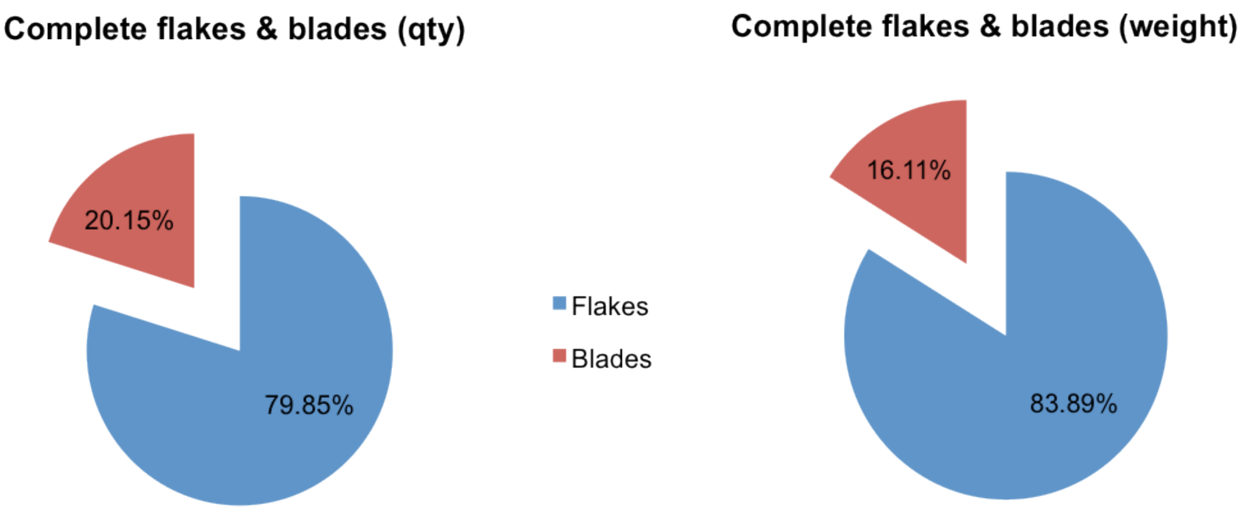


Fig. 6.8. Complete debitage subdivided into flakes and blades according to their quantity and weight.

Figure 6.7. adds further detail to data displayed in Table 6.5 by clarifying the relationship between blades and flakes. As previously anticipated (see Chapter 4) blades are conventionally defined as debitage pieces the length of which is double their width. The length/width ratio of blades is therefore equal to or greater than 2.0, whereas flakes present a length/width ratio of less than 2.0. The difference between the two debitage categories is also further defined by a series of attributes which will be explored at length further on, when both categories will be closely analysed. Whilst Figure 6.7 takes into consideration all debitage, i.e. even the fragmentary pieces, Figure 6.8 displays quantities and weights of complete artefacts only. Despite their

fragmentation, both distal and proximal artefact portions still carry with them diagnostic traits allowing for unambiguous classification. The same cannot be said for fragments, i.e. debitage which has survived without a proximal or distal end. In this latter case, however, parallel edges on blade fragments at times combined with parallel scars on the dorsal surface did not leave any doubt about their attribution. On the contrary, it is likely that fragments with less diagnostic traits were attributed to the flake category, and it is therefore probable that the latter is overrepresented in the fragment category.

Ratio Length/Width	Artefact type	Rivoli Castelnuovo I		Rivoli Castelnuovo II	
		Qty	%	Qty	%
> 6	Micro-blade	6	0.2%	0	0.0%
≤ 6 > 3	Bladelet	104	3.4%	14	3.2%
≤ 3 > 2	Blade	408	13.2%	69	15.8%
≤ 2 > 1.50	Blade-like-Flake	1519	49.3%	94	21.6%
≤ 1.5 > 1	Flake	576	18.7%	141	32.3%
≤ 1 > 0.75	Large Flake	331	10.7%	75	17.2%
≤ 0.75 ≥ 0.50	Very Large Flake	136	4.4%	39	8.9%
< 0.50	Macro-flake	4	0.1%	4	0.9%
Total		*3084*	*100.0%*	*436*	*100.0%*

Table 6.12. Rocca di Rivoli debitage subdivided into Bagolini's (1968) artefact categories (numerical quantities, complete artefacts only).

As anticipated in Chapter 4 additional categories of blades and flakes were proposed, among others, by Bernardino Bagolini (Bagolini 1968) and have since been employed in Italian prehistoric lithic studies in order to further characterize assemblage variability. Table 6.12 shows Rocca di Rivoli debitage subdivided into Bagolini's sub-categories. This clearly displays a preference for blade-like-flakes over flakes or blades in the earlier phase (Rivoli Castelnuovo I) which ceases to exist in the Rivoli Castelnuovo II phase, where knapping was directed mainly towards the production of flakes, followed by blade-like-flakes and large flakes. Despite their usefulness for identifying patterns in the archaeological sample analysed, it remains to understand how these categories could relate to possible prehistoric knapping objectives.

Figure 6.9 shows quantities of debitage collected per pit. Again, it is immediately noticeable how the assemblage made up of pits P, Q and R produced the highest number of debitage pieces (total of 968). Pits V and W also produced considerable quantities (692 and 508 respectively).

Figure 6.10 presents percentages (numerical quantity and weight) of flakes and blades for each archaeological phase. Artefacts belonging to the Rivoli Chiozza phase are too scanty to provide a weight distribution curve (respectively 29 complete flakes and 4 complete blades). For the other two phases a comparison can be drawn by looking at Figures 6.11 to 6.14 as well as Tables 6.13 to 6.16. The first thing to note is how the weight interval displaying the vast majority of artefacts for both phases is the one between 1 and 5g. It is interesting to see how weight intervals of flakes and blades from the Rivoli Castelnuovo II phase do not stretch as far as those of the previous archaeological phase. While artefacts weighing more than 30g for flakes and more than 20g for blades are rare within the Rivoli Castelnuovo I assemblage, they are totally absent from Rivoli Castelnuovo II contexts.

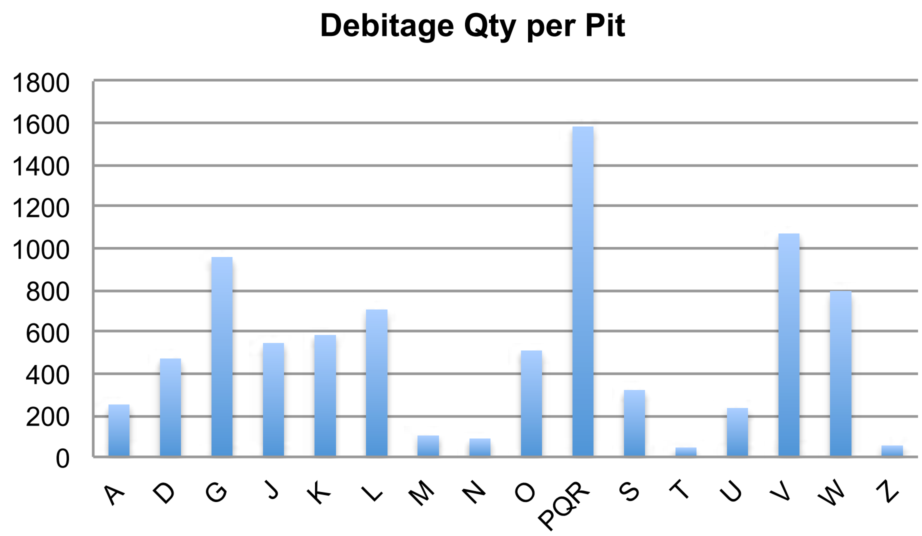


Fig. 6.9. Distribution of debitage per pit at Rocca di Rivoli (numerical quantities).

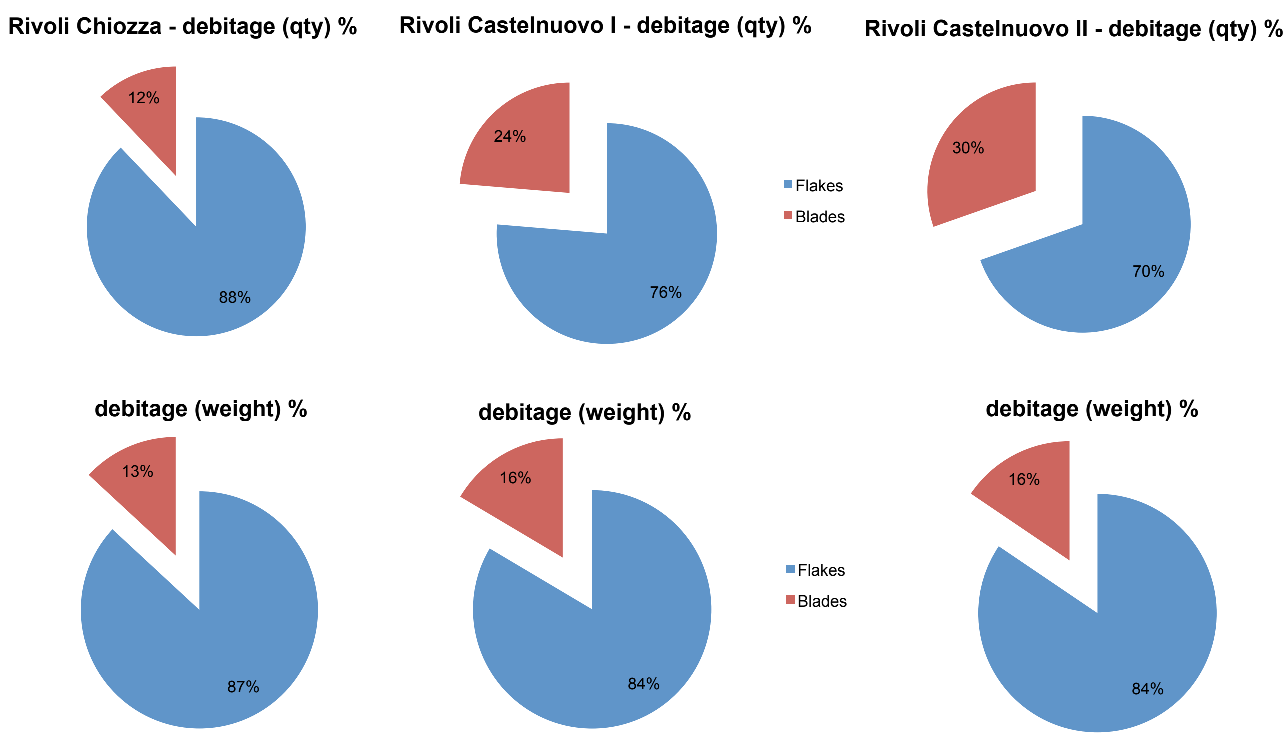


Fig. 6.10. Debitage composition according to occupational phase (numerical quantities and weight).

Weight interval (gr.)	Qty	%
≤ 0.1 ≤ 1	658	26.26%
> 1 ≤ 5	1388	55.39%
> 5 ≤ 10	322	12.85%
> 10 ≤ 20	110	4.39%
> 20 ≤ 30	20	0.80%
> 30	8	0.32%
Total	***2506***	***100.00%***

Table 6.13. Rivoli Castelnuovo I complete flakes, subdivided by weight intervals.

Weight interval (gr.)	Qty	%
≤ 0.1 ≤ 1	199	34.43%
> 1 ≤ 5	310	53.63%
> 5 ≤ 10	53	9.17%
> 10 ≤ 20	12	2.08%
> 20 ≤ 30	3	0.52%
> 30	1	0.17%
Total	***578***	***100.00%***

Table 6.14. Rivoli Castelnuovo I complete blades, subdivided by weight intervals.

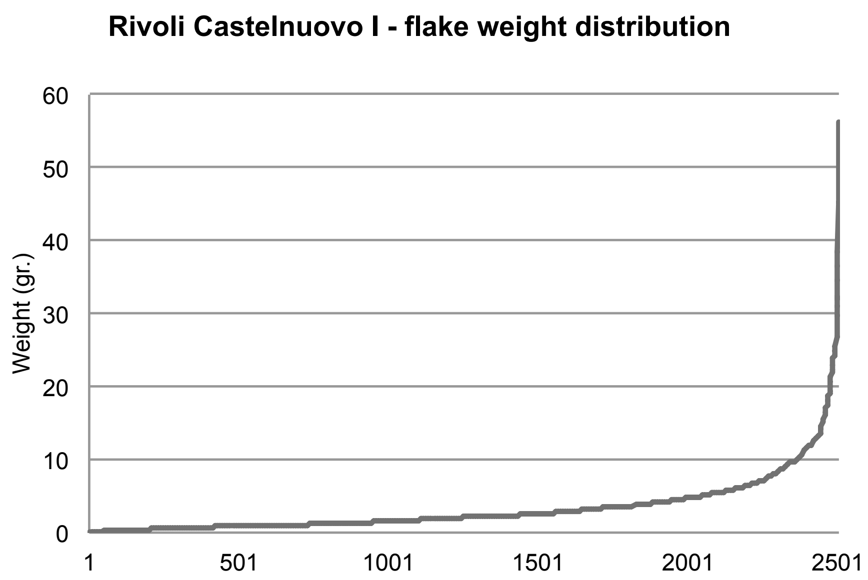


Fig. 6.11. Curve showing weight distribution of complete flakes coming from Rivoli Castelnuovo I contexts.

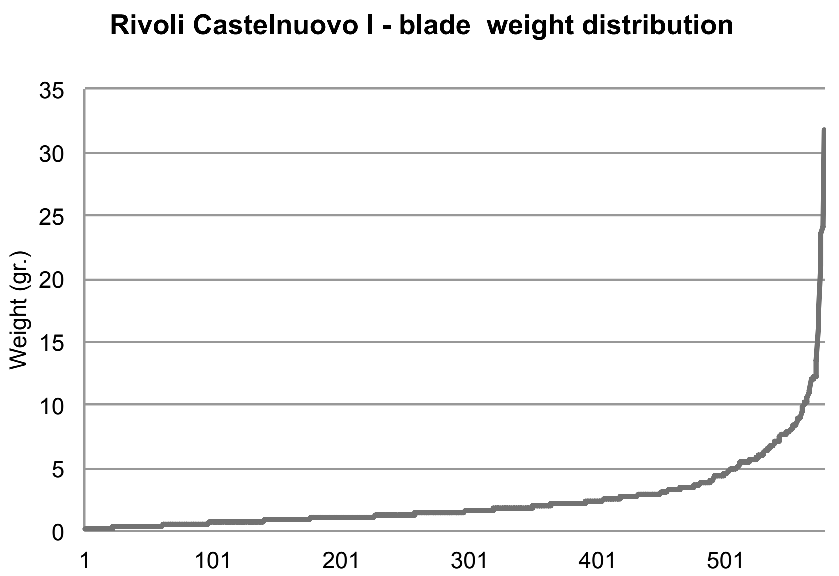


Fig. 6.12. Curve showing weight distribution of complete blades coming from Rivoli Castelnuovo I contexts.

Weight interval (gr.)	Qty	%
≤ 0.1 ≤ 1	56	16.33%
> 1 ≤ 5	226	65.89%
> 5 ≤ 10	44	12.83%
> 10 ≤ 20	15	4.37%
> 20 ≤ 30	2	0.58%
Total	***343***	***100.00%***

Table 6.15. Rivoli Castelnuovo II, complete flakes.

Weight interval (gr.)	Qty	%
≤ 0.2 ≤ 1	29	30.85%
> 1 ≤ 5	56	59.57%
> 5 ≤ 10	6	6.38%
> 10	3	3.19%
Total	***94***	***100.00%***

Table 6.16. Rivoli Castelnuovo II, complete blades.

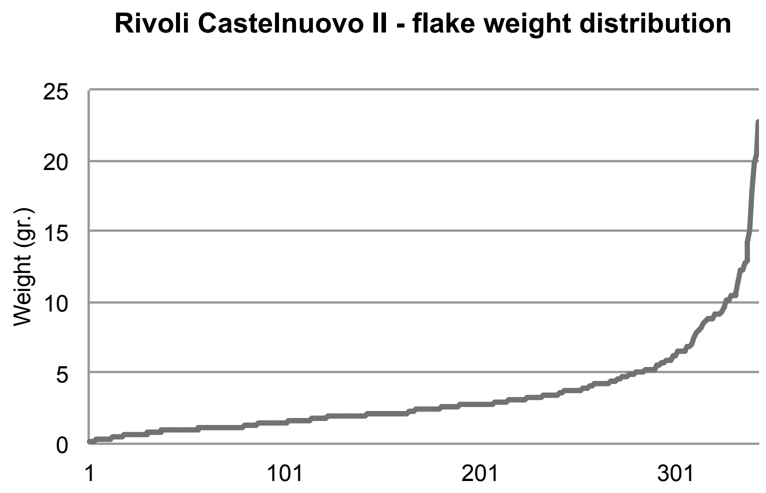


Fig. 6.13. Curve showing weight distribution of complete flakes coming from Rivoli Castelnuovo II contexts.

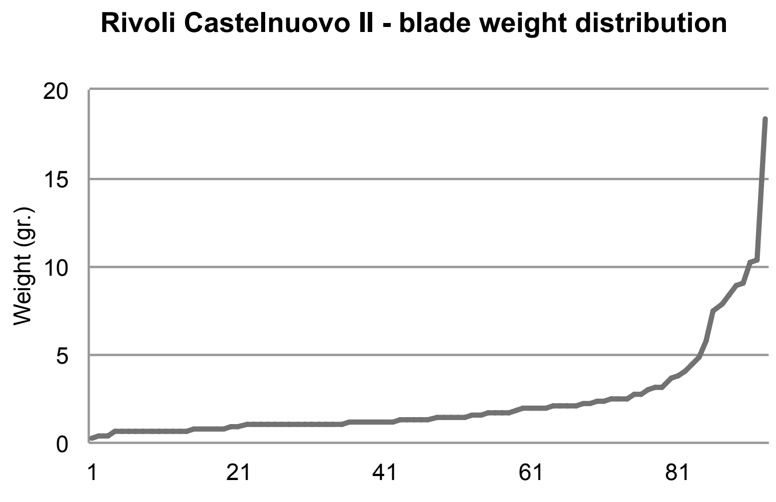


Fig. 6.14. Curve showing weight distribution of complete blades coming from Rivoli Castelnuovo II contexts.

Debris

Debris were defined Bordes as early as 1947 as shapeless fragments whose mode of fracture cannot be identified, and which cannot be assigned to any category of knapped objects. After Crabtree (1972: 58) debris coming from Rocca di Rivoli are differentiated as follows:

1. Chips (less than 15mm);
2. Chunks (more than 15mm);
3. Chunks (larger than 3cm);
4. Core shatters.

Debris Type	Qty	%	Weight	%
Chips	600	29.8%	558.4	7.5%
Chunks	989	49.1%	2355.9	31.8%
Chunks larger than 3cm	320	15.9%	2594.2	35.0%
Core shatters	105	5.2%	1897.9	25.6%
Total	*2014*	*100.0%*	*7406.4*	*100.0%*

Table 6.17. Debris assemblage subdivided into the different artefact categories.

A total of 2014 pieces of debris were recorded among the artefacts coming from the Neolithic deposits at Rocca di Rivoli. A closer look at the different types of artefacts making up this group is given in Table 6.17. Debris provide little information about knapping at Rocca di Rivoli, but it is interesting to note how most of them (83.9%) have fresh breaks. Only a tiny part of the assemblage displays edges which were damaged (15.6%) and a minuscule percentage shows probably used edges (0.5%).

Retouched artefacts

Retouched artefacts are debitage pieces modified through removal of small flakes (retouch) from their edges and, in some more elaborate examples, from one or both faces of the artefact (flat pressure retouch). Retouched artefacts are also referred to as formalised tools, the edges of which and/or faces have been modified to obtain a pre-determined shape.

A total of 1156 retouched artefacts come from the Neolithic contexts at Rocca di Rivoli. Their weight of 6,200.6g (plotted in Fig. 6.14) represents approximately 18% of the total Rocca di Rivoli assemblage.

When looking closer at the data collected (Table 6.18), mean retouched artefact weight is 4.5g and 6.6g for retouched blades and flakes respectively. The median is 4.6g (blades) and 4.85g (flakes). The heaviest retouched blade weighs 25g whereas the lightest weighs 0.2g. As for retouched flakes, the heaviest weighs 42.5g and the lightest 0.3g. Standard deviation from the mean is 4.6g for retouched blades and 5.8g for retouched flakes.

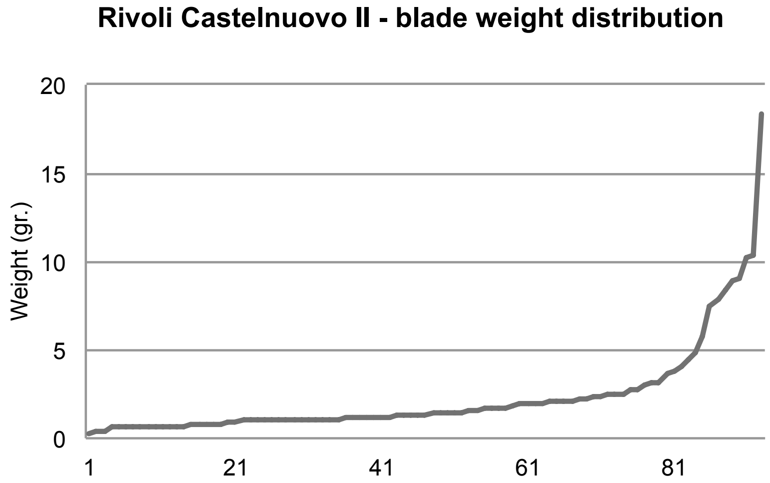


Fig. 6.14. Curve showing weight distribution of complete blades coming from Rivoli Castelnuovo II contexts.

Weigth values (grams)	Blades	Flakes
Average	4.5	6.6
Max value	25	42.5
Min value	0.2	0.3
Median	4.6	4.85
Standard Dev.	4.6	5.8
Tot. Weight	895.2	3,081.0

Table 6.18. Comparison of weight values between retouched blades and flakes.

A closer look at the nature of the retouched artefact assemblage shows that the majority of both retouched flakes and blades fall in the weight interval between 1 and 5g (Tables 6.20 and 6.21). Only 3 retouched flakes weigh more than 30g (Table 6.22).

Weight interval (gr.)	Qty	%	Weight interval (gr.)	Qty	%
≤ 0.3 ≤ 1	20	4.27%	> 10 ≤ 20	76	16.24%
> 1 ≤ 5	220	47.01%	> 20 ≤ 30	16	3.42%
> 5 ≤ 10	133	28.42%	> 30	3	0.64%
Total	*373*	*79.70%*		*95*	*20.30%*

Table 6.19. Complete retouched flakes weight distribution according to weight intervals.

Weight interval (gr.)	Qty	%	Weight interval (gr.)	Qty	%
≤ 0.2 ≤ 1	32	16.08%	> 10 ≤ 20	16	8.04%
> 1 ≤ 5	107	53.77%	> 20 ≤ 30	4	2.01%
> 5 ≤ 10	40	20.10%	> 30	0	0.00%
Total	*179*	*89.95%*		*20*	*10.05%*

Table 6.20. Complete retouched blades weight distribution according to weight intervals.

Fragmentation	Qty	%	Weight (gr.)	%
Complete	468	56.9%	3081	61.9%
Distal	86	10.5%	442.5	8.9%
Proximal	62	7.5%	328.9	6.6%
Fragment	206	25.1%	1122.9	22.6%
Total	*822*	*100.0%*	*4975.3*	*100.0%*

Table 6.21. Fragmentation of retouched flakes.

Fragmentation plays, once again, an important role: approximately 42% of the overall retouched assemblage is fragmented, with some differences between flakes and blades. (Tables 6.22 and 6.23).

Fragmentation	Qty	%	Weight (gr.)	%
Complete	199	59.6%	895.2	73.1%
Distal	62	18.6%	183.1	14.9%
Proximal	37	11.1%	74	6.0%
Fragment	36	10.8%	73	6.0%
Total	*334*	*100.0%*	*1225.3*	*100.0%*

Table 6.22. Fragmentation of retouched blades.

Length/Width Ratio	Artefact Type	Qty	%
> 6	Micro-blade	2	0.3%
≤ 6 and > 3	Bladelet	44	6.6%
≤ 3 and > 2	Blade	140	21.0%
≤ 2 and > 1.5	Blade-like-Flake	177	26.5%
≤ 1.5 and > 1	Flake	207	31.0%
≤ 1 and > 0.75	Large flake	70	10.5%
≤ 0.75 and > 0.50	Very large flake	27	4.0%
< 0.50	Macro-flake	0	0.0%
Total		*667*	*100.0%*

Table 6.23. Retouched artefact assemblage subdivided into Bagolini’s (1968) subcategories for blades and flakes.

The majority of retouched artefacts are represented by retouched flakes (Figs. 6.16 and 6.17). Flake fragments also feature prominently in the assemblage. Some caution needs to be used here since it is possible that those blade fragments not displaying clear blade attributes (such as parallel edges or parallel arrises) were classified as flake fragments.

When looking at the retouched assemblage through the categories proposed by Bernardino Bagolini (1968: 199) (Table 6.24) it is immediately clear that there are some differences with the same data coming from the debitage assemblage (Table 6.12). These differences will be explored further in order to understand whether they can be held to reflect some of the knappers’ choices at the site.

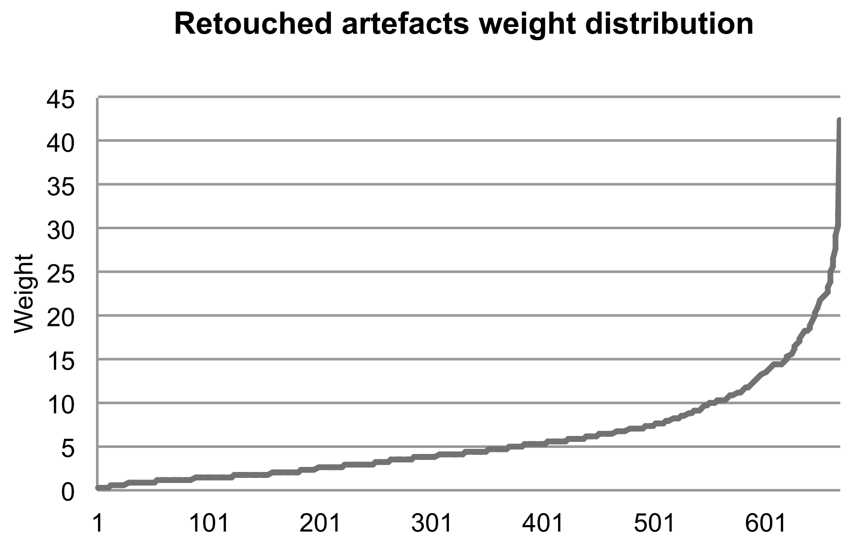


Fig. 6.15. Curve describing retouched artefacts weight distribution (grams).

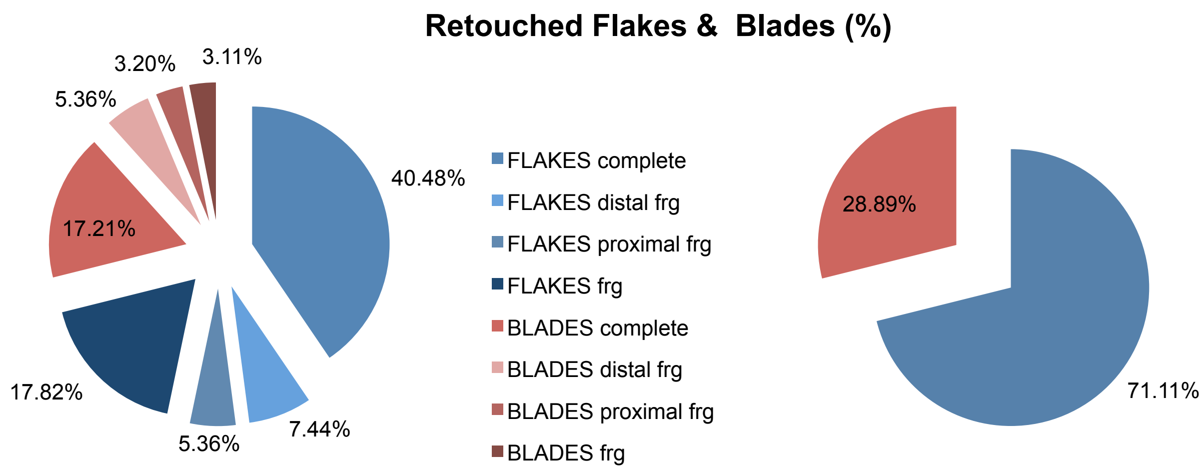


Fig. 6.16. Retouched artefacts assemblage subdivided by retouched flakes and blades and their fragmentary pieces (numerical quantity).

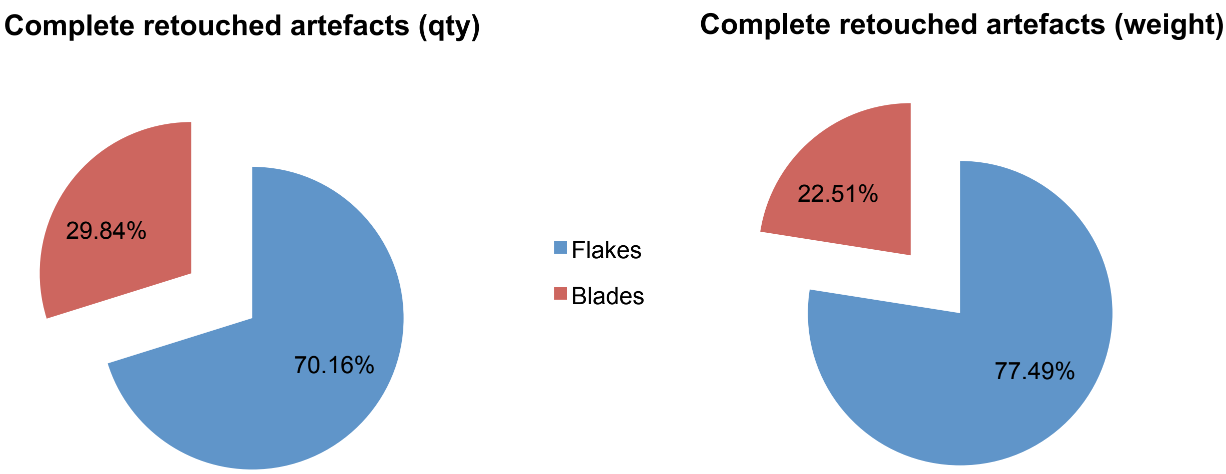


Fig. 6.17. Complete retouched artefacts subdivided into blades and flakes according to their quantity and weight.

Fig. 6.18 presents quantities of retouched artefacts collected per pit. Once again, the assemblage made up of pits P, Q and R produced the highest number of retouched flakes and blades (total of 248). As previously anticipated this is to do with the decision to group artefacts coming from the three pits as belonging to one episode of deposition. Pits G, W and V also produced considerable quantities (156, 121 and 114 respectively).

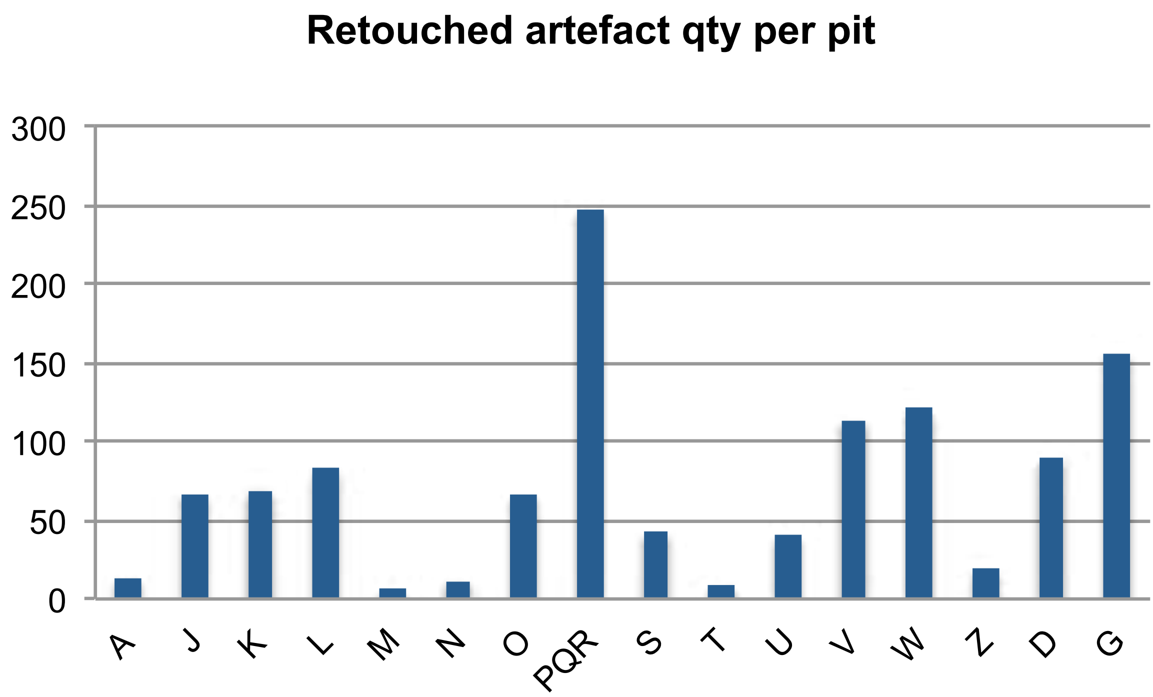


Fig. 6.18. Distribution of retouched artefacts per pit at Rocca di Rivoli (numerical quantities).

Charts in Figures 6.19 and 6.20 show the flake-blade ratio according to occupation phases at the site whereas Table 6.24 explores further the nature of the retouched artefacts assemblage in relation to the categories proposed by Bagolini (1968).

When looking at Table 6.24 it can be noticed how very large flakes decrease and blade-like-flakes increase in the Rivoli Castelnuovo II phase. Tables 6.25 to 6.28 along with Figures 6.21 to 6.24 focus on the weight of complete retouched blades and flakes coming from the two occupation phases.

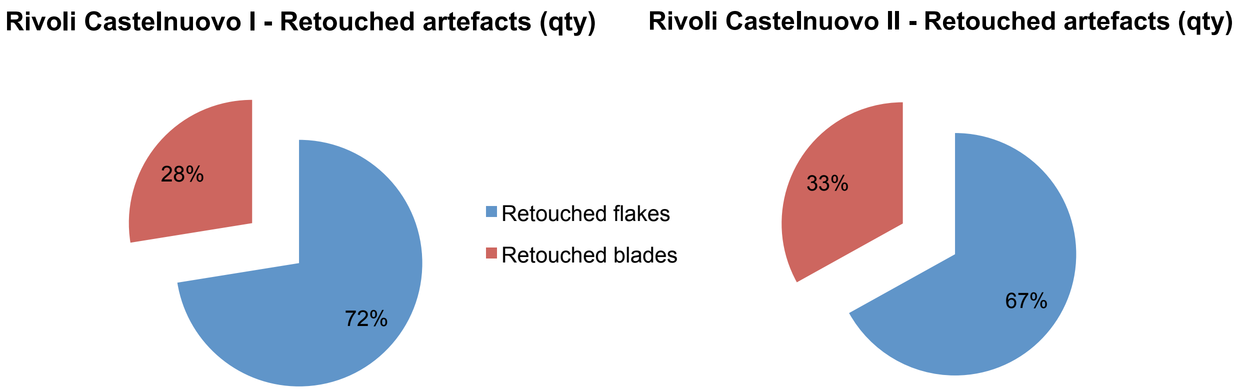


Fig. 6.19. Retouched artefact assemblage composition according to occupation phase (numerical quantities).

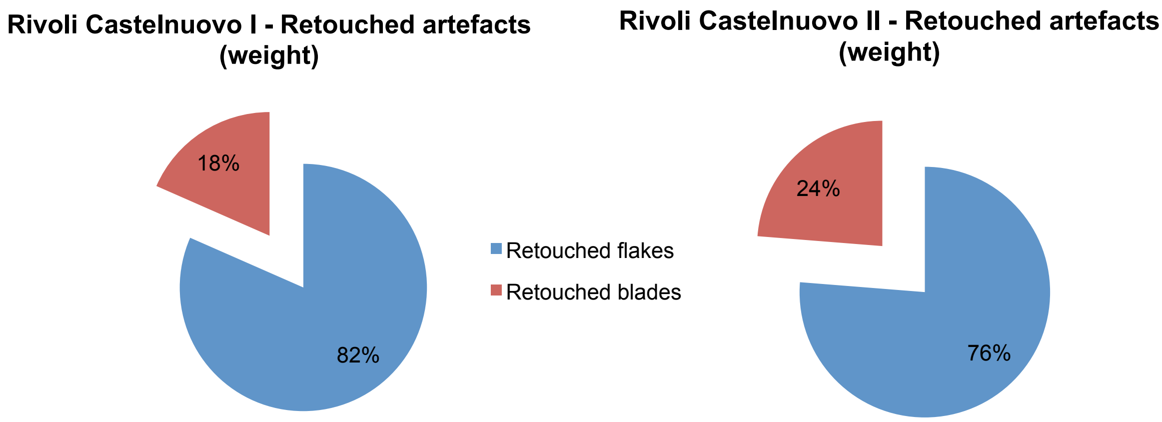


Fig. 6.20. Retouched artefact assemblage composition according to occupation phases (weight).

Length/Width Ratio	Artefact Type	Rivoli Castelnuovo I		Rivoli Castelnuovo II	
		Qty	%	Qty	%
> 6	Micro-blade	2	0.4%	0	0.0%
≤ 6 and > 3	Bladelet	38	6.8%	6	5.4%
≤ 3 and > 2	Blade	116	20.9%	24	21.4%
≤ 2 and > 1.5	Blade-like-Flake	142	25.6%	35	31.3%
≤ 1.5 and > 1	Flake	173	31.2%	34	30.4%
≤ 1 and > 0.75	Large flake	60	10.8%	10	8.9%
≤ 0.75 and > 0.50	Very large flake	24	4.3%	3	2.7%
< 0.50	Macro-flake	0	0.0%	0	0.0%
Total		*555*	*100.0%*	*112*	*100.0%*

Table 6.24. Comparison of retouched artefacts coming from the two main occupation phases according to Bagolini's (1968) categories (numerical quantitites of complete artefacts).

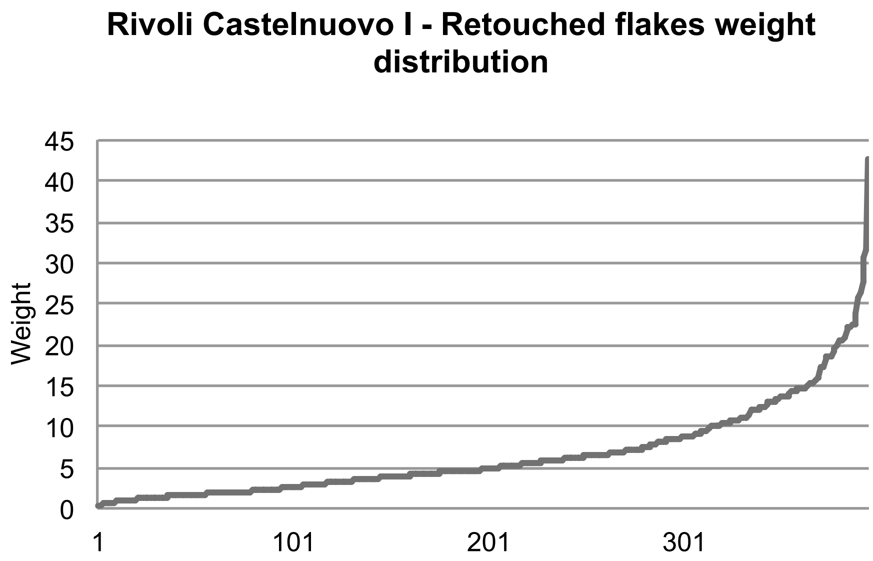


Fig. 6.21. Curve showing weight distribution of retouched flakes coming from Rivoli Castelnuovo I contexts.

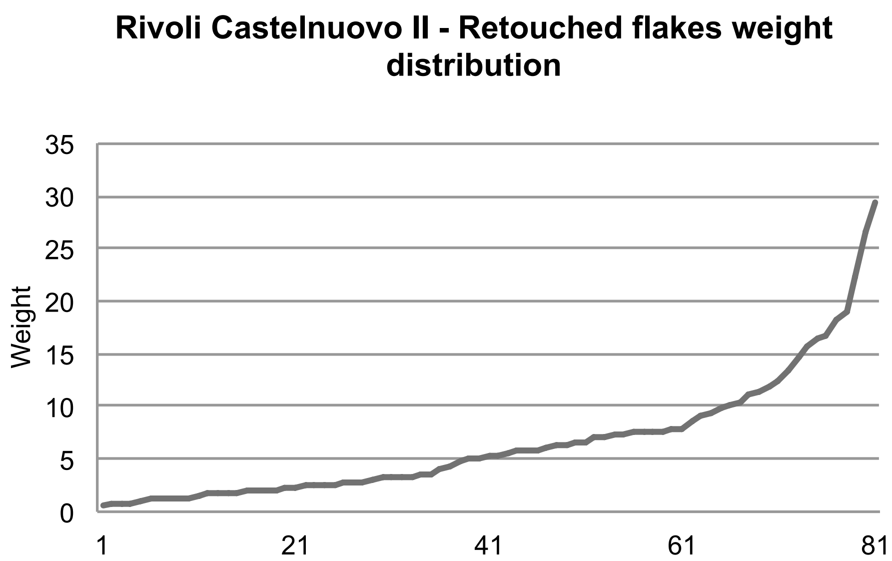


Fig. 6.22. Curve showing weight distribution of retouched flakes coming from Rivoli Castelnuovo II contexts.

Weight interval (gr.)	Qty	%
≤ 0.3 ≤ 1	14	3.54%
> 1 ≤ 5	192	48.61%
> 5 ≤ 10	109	27.59%
> 10 ≤ 20	64	16.20%
> 20 ≤ 30	13	3.29%
30+	3	0.76%
Total	***395***	***100.00%***

Table 6.25. Rivoli Castelnuovo I, complete flakes.

Weight interval (gr.)	Qty	%
≤ 0.6 ≤ 1	4	4.94%
> 1 ≤ 5	35	43.21%
> 5 ≤ 10	27	33.33%
> 10 ≤ 20	12	14.81%
> 20+	3	3.70%
Total	***81***	***100.00%***

Table 6.26. Rivoli Castelnuovo II, complete flakes.

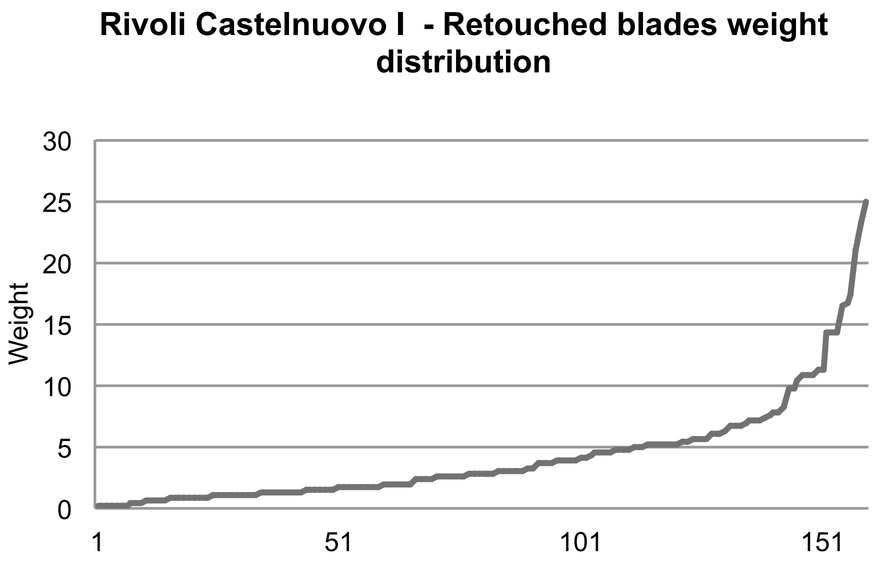


Fig. 6.23. Curve showing weight distribution of retouched blades coming from Rivoli Castelnuovo I contexts.

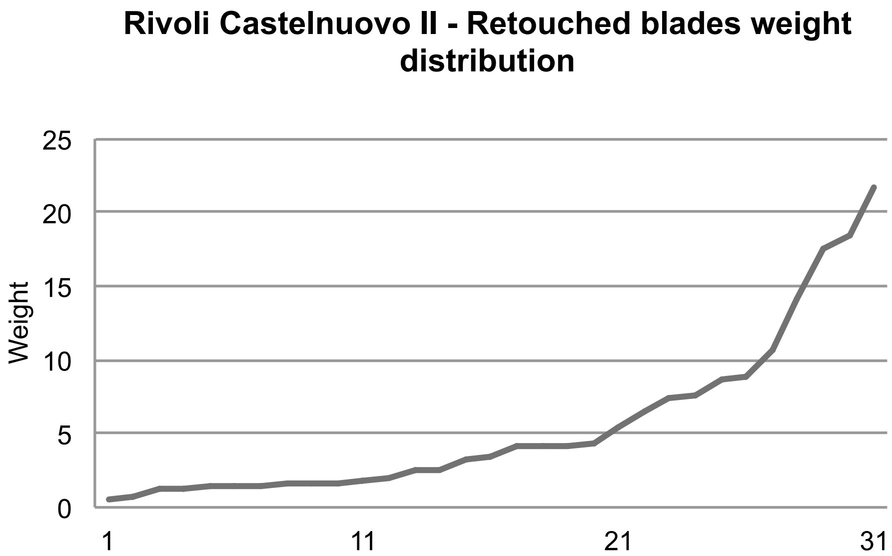


Fig. 6.24. Curve showing weight distribution of retouched blades coming from Rivoli Castelnuovo II contexts.

Weight interval (gr.)	Qty	%
≤ 0.2 ≤ 1	32	20.00%
> 1 ≤ 5	82	51.25%
> 5 ≤ 10	31	19.38%
> 10 ≤ 20	12	7.50%
> 20+	3	1.88%
Total	***160***	***100.00%***

Table 6.27. Rivoli Castelnuovo I, complete blades.

Weight interval (gr.)	Qty	%
≤ 0.5 ≤ 1	2	6.45%
> 1 ≤ 5	18	58.06%
> 5 ≤ 10	6	19.35%
> 10 ≤ 20	4	12.90%
> 20+	1	3.23%
Total	***31***	***100.00%***

Table 6.28. Rivoli Castelnuovo II, complete blades.

Conclusions

This section has outlined the lithic assemblage unearthed at Rocca di Rivoli. Only two out of the three archaeological phases identified at the site provided enough material to make it statistically worthwhile to be investigated in order to draw possible meaningful patterns. Material coming from Rivoli Chiozza deposits, although initially included in the database, was not included in further analysis. The next analytical stages will therefore concentrate on material coming from the Rivoli Castelnuovo I and II deposits only. There is sufficient data to allow for further analysis and comparison between the two phases and the variables selected in Chapter 4.

The next section will analyse both assemblages by looking at the variables that are associated with raw material exploitation, starting with procurement. Some of the questions in mind when setting out to analyse attributes relating to raw material procurement and exploitation are:

1. What type of raw material were knappers selecting and why?
2. Where was the raw material coming from and how was it brought to the site?
3. How was the procurement organized?

Chapter 7

RAW MATERIAL PROCUREMENT

Raw material procurement, how this is organized and carried out, is the first stage in any *chaîne opératoire*. Analysis focused on those recorded attributes which carry with them information about the way in which flint was brought to the site to be worked. The first thing wanted to be known is which kind of raw material flint knappers were after, whether they had any preferences and why. How flint was brought to site, both in terms of who was bringing it (was it the same knapper producing the artefacts or not?) and how (flint was reaching the site as pre-cores, unworked nodules or rough-outs ready to be retouched into tools?) is another question formulated at the start of the present research. Finally, it would be useful to know where the flint was coming from, since to be able to locate the source (e.g. primary outcrop or secondary deposit?), although approximately, informs us about knappers' choices in terms of flint quality and accessibility as well as resource control and procurement modality. Unfortunately, as discussed in Chapter 5, precise characterisation of flint sources for the Lessini Mountains is not possible for the time being (Cremaschi 1981).

The main difficulties to keep in mind when extrapolating information about raw material procurement and raw material in general are the ambiguity of lithotype identification (i.e. there is no 100% sure attribution) and the fragmentary nature of the archaeological data.

Table 7.1 and Figure 7.1 show the distribution of raw material within the sampled assemblage. More than 50% is represented by flint coming from the Maiolica flint source. The second most common raw material type is flint of the Scaglia Variegata formation. All the other litho-types are quantitatively less important although it is interesting to note that among the "other" category there are pieces of quartz and limestone.

Unidentifiable artefacts are respectively 18.81% (numerical quantity) and 14.86% (weight) of the total assemblage. There are several reasons to account for the lack of identification.

Raw Material	Debitage Total		Retouched Total		Cores		**TOTAL**	
	Qty	Weight	Qty	Weight	Qty	Weight	**Qty**	**Weight**
not identifiable	1462	4262.8	87	378.2	13	412.4	**1562**	**5053.4**
Oolitico di San Vigilio	33	188.2	6	73.7	0	0	**39**	**261.9**
Scaglia Rossa	297	1158.2	52	239.1	13	378.3	**362**	**1775.6**
Scaglia Variegata	1129	3821.9	227	1341.1	42	1433.6	**1398**	**6596.6**
Maiolica	3945	11904.6	750	3974.4	112	3528.4	**4807**	**19407.4**
Rosso Ammonitico	4	41.4	2	9.4	2	60.8	**8**	**111.6**
Eocene	84	385.7	32	184.7	3	192.6	**119**	**763**
Other	5	26.8			0	0	**5**	**26.8**
TOTAL	**6959**	**21789.6**	**1156**	**6200.6**	**185**	**6006.1**	**8300**	**33996.3**

Table 7.1. Distribution of artefact categories according to raw material type (numerical quantities and weight).

Fig. 7.1. Raw material type distribution according to numerical quantity (left) and weight (right).

Figure 7.2 takes these into consideration. It is interesting to note that approximately 80% of the unidentified artefacts comprise burnt or thermally modified artefacts. These count up to 15% of the total assemblage. For 16.66% of the unidentified artefacts there is no information about the rock formation it comes from. The main reason for non attribution here is a lack of confidence on the part of the analyst.

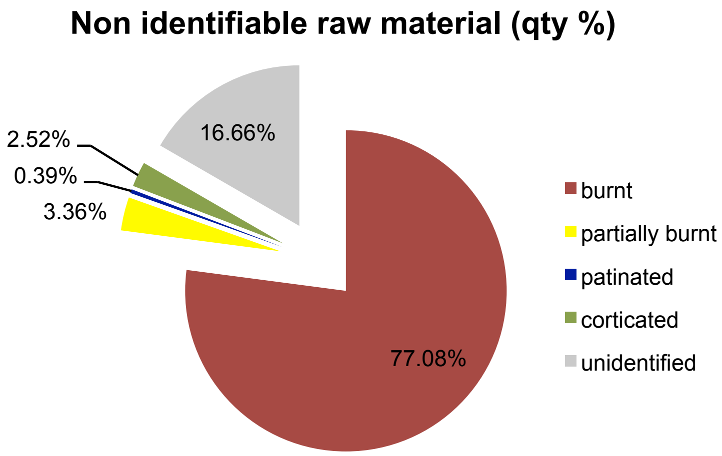


Fig. 7.2. Reasons preventing identification of raw material.

In addition to raw material type, raw material characteristics might also be taken into consideration during the knappers' decision making processes. Litho-type colour was recorded for all knapped lithics, with the exception of the debris category. Debris were left out since their dimensions and often altered conditions (thermal alteration, patination) greatly affect the identification of litho-type characteristics.

Figure 7.3 shows the frequency of colour types based on Munsell Colour Chart attributes. We can see that those colours expressing different shades of gray are the most represented, regardless of artefact category and raw material type.

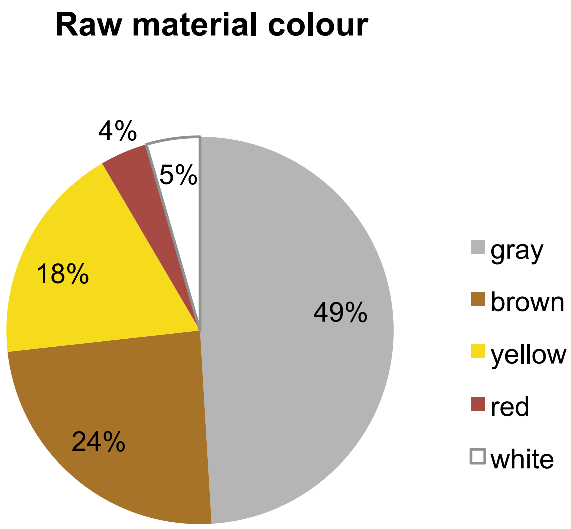


Fig. 7.3. Rocca di Rivoli artefacts subdivided by their colour category (numerical quantities).

The identification of a parent material type might be as tricky as attributing a raw material type (see Chapter 5). Figure 7.4 presents an attempt at this exercise through the analysis of the traces left on the artefacts collected at Rocca di Rivoli. A very tiny percentage of the assemblage could be attributed parent material: respectively 6% (numerical quantity) and 13% (weight) of the entire assemblage.

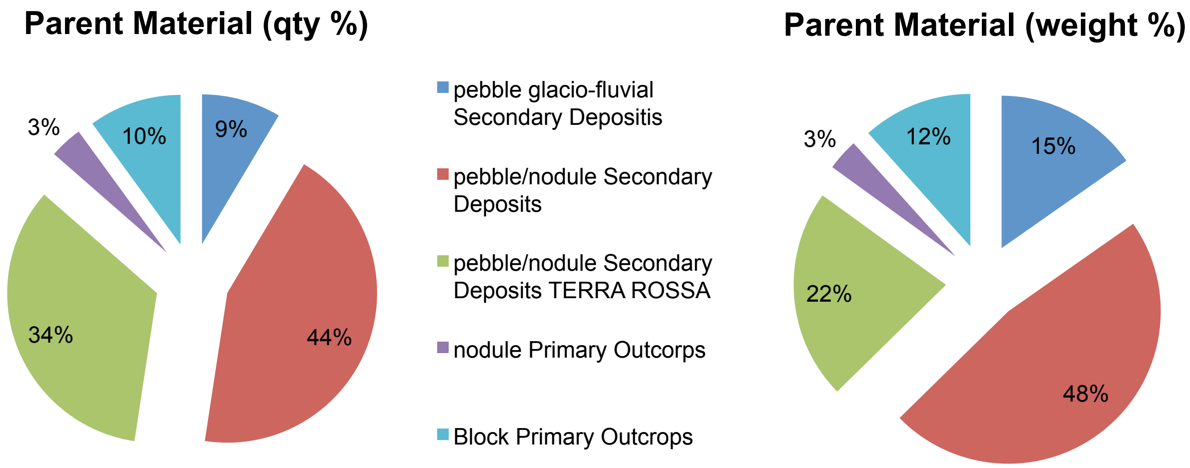


Fig. 7.4. Identification of parent material types: numerical quantities (left), weight in grams (right).

Reasons for such low percentages are to be attributed to a series of factors. Firstly, a high percentage of artefacts have no cortex or have too small a portion of cortex (less than 50%): respectively 65% and 26% (numerical quantities). Even when corticated surfaces survived, thermal alteration or other types of alterations (patina, discoloration, abrasion) further narrowed the chances of identifying cortex attributes indicating outcrop type. Lastly, in the same way as for raw material, the absence of unambiguous attributes weakens the analyst's confidence in identifying a specific parent material.

Figure 7.4 shows that the majority of the identified parent material belongs to the secondary deposit category. Only 13% (numerical quantity) or 15% (weight) of the identified artefacts could be attributed to primary outcrops. Table 7.2 provides additional details as in which raw material comes from which type of source (be it primary outcrops or secondary deposits) per artefact category. Again, despite the need for caution when looking at this data, it is immediately noticeable how the most common raw material types (those coming from the Maiolica and Scaglia Variegata formations) present a wider spectrum of procurement options, since they could be obtained from either secondary deposits or primary outcrops.

Retouched blades								
Parent Material	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Non identifiable	Total
Pebble glacio-fluvial Secondary Depositis				1				1
Pebble/nodule Secondary Deposits		1	5	9		1	1	17
Pebble/nodule Secondary Deposits TERRA ROSSA				4				4
Nodule Primary Outcorps								
Block Primary Outcrops								
Total		*1*	*5*	*14*		*1*	*1*	*22*
Retouched flakes								
Parent Material	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Non identifiable	Total
Pebble glacio-fluvial Secondary Depositis			2	1		1	1	5
Pebble/nodule Secondary Deposits	1	2	6	24		1	1	35
Pebble/nodule Secondary Deposits TERRA ROSSA			2	12			1	15
Nodule Primary Outcorps			1	2				3
Block Primary Outcrops			1	1		1		3
Total	*1*	*2*	*12*	*40*		*3*	*3*	*61*
Debitage blades								
Parent Material	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Non identifiable	Total
Pebble glacio-fluvial Secondary Depositis				1				1
Pebble/nodule Secondary Deposits			10	12		1		23
Pebble/nodule Secondary Deposits TERRA ROSSA	1	2	2	18		2		25
Nodule Primary Outcorps								
Block Primary Outcrops			2	8		1	1	12
Total	*1*	*2*	*14*	*39*		*4*	*1*	*61*
Debitage flakes								
Parent Material	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Non identifiable	Total
Pebble glacio-fluvial Secondary Depositis		3	5	13			1	22
Pebble/nodule Secondary Deposits		13	20	72		4	5	114
Pebble/nodule Secondary Deposits TERRA ROSSA	1	4	17	88		2	5	117
Nodule Primary Outcorps		2	4	6		1	1	14
Block Primary Outcrops			2	21			2	25
Total	*1*	*22*	*48*	*200*		*7*	*14*	*292*
Cores								
Parent Material	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Non identifiable	Total
Pebble glacio-fluvial Secondary Depositis		2	7	3				12
Pebble/nodule Secondary Deposits		4	6	11				21
Pebble/nodule Secondary Deposits TERRA ROSSA				2				2
Nodule Primary Outcorps								
Block Primary Outcrops			1	5		1	1	8
Total		*6*	*13*	*21*			*1*	*43*

Table 7.2. Parent material attribution associated with raw material type according to artefact category (numerical quantity only).

Cores

From both Table 7.3 and Figure 7.5 it clearly stands out how flint from the Maiolica rock formation (61.39%) is by far the most abundant raw material present on site, followed by that coming from Scaglia Variegata outcrops (21.29%). Flint belonging to Scaglia Rossa is present

Raw Material Type	Cores	%	Flake-cores	%	Total	%	Core shatters	%
not identifiable	13	7.03%	0	0.00%	13	7.03%	27	25.71%
Oolitico di S.Vigilio	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Scaglia Rossa	6	3.24%	7	3.78%	13	7.03%	9	8.57%
Scaglia Variegata	28	15.14%	14	7.57%	42	22.70%	18	17.14%
Maiolica	80	43.24%	32	17.30%	112	60.54%	49	46.67%
Rosso Ammonitico	2	1.08%	0	0.00%	2	1.08%	0	0.00%
Eocene	2	1.08%	1	0.00%	3	1.62%	2	1.90%
Total	**131**	**70.81%**	**54**	**28.65%**	**185**	**100.00%**	**105**	**100.00%**

Table 7.3. Percentage values of cores and cores shatters numerical quantities according to raw material types.

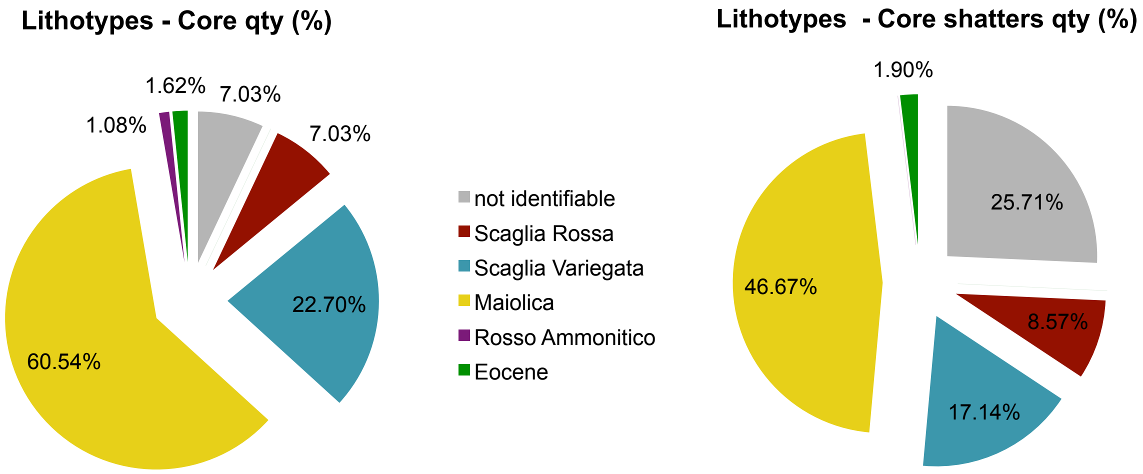


Fig. 7.5. Percentage values of cores and core shatters numerical quantities according to raw material types.

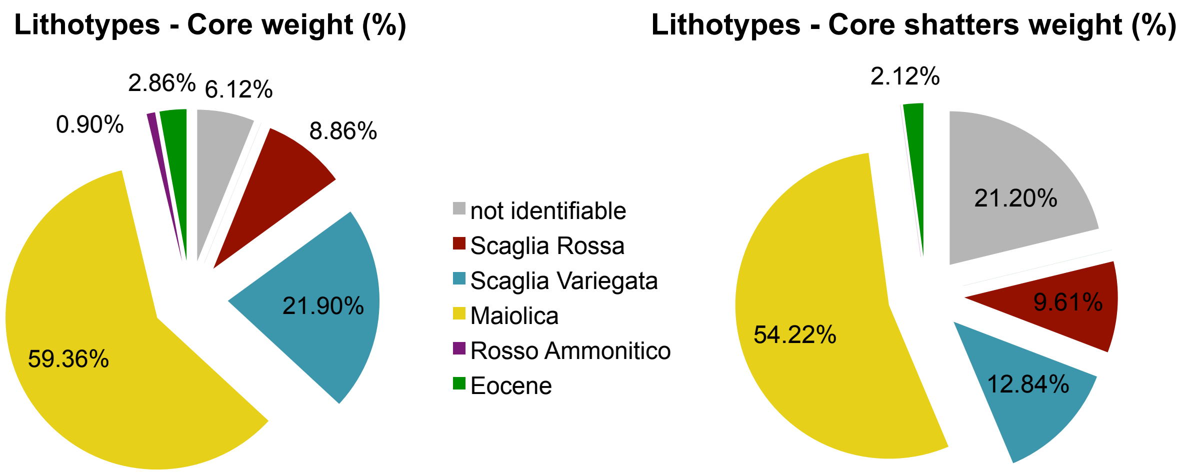


Fig. 7.6. Percentage values of cores and core shatters weight according to raw material types.

in similar percentages in both cores and core shatters assemblages (respectively 8.42% and 7.56%). Rosso Ammonitico (0.99%) and Eocene (1.49%) provide only a few cores altogether. In addition, whereas core shatters were identified as belonging to the latter lithotype, although in very small quantity (1.68%), no Rosso Ammonitico core shatters are present. Neither cores nor core shatters of Oolitico di San Vigilio flint were identified. It is important to point out that the percentage of non identifiable cores amounts to 7.03% of the total core assemblage. Non-identifiable core shatters are comparatively higher: 25.71%. Reasons for failing to attribute raw material type are summarized in Table 7.4.

Reasons for recording non-identifiable artefacts	Cores		Core shatters	
	Qty	%	Qty	%
Burning	11	84.6%	25	92.6%
Partial thermal alteration	2	15.4%	1	3.7%
Not specified			1	3.7%
Total	**13**	**100%**	**27**	**100%**

Table 7.4. Reasons for lack of lithotype identification for cores and core shatters.

Table 7.5 quantifies cores and core shatters by taking into consideration their weight, allowing in this way to compare litho-type percentages resulting from individuals count with those resulting from their corresponding numerical quantities (Table 7.3).

Raw Material Type	Cores	%	Flake-cores	%	Total	Total %	Core shatters	%
not identifiable	412.4	6.87%	0.0	0.00%	412.4	6.87%	493.1	21.20%
Oolitico di S.Vigilio	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Scaglia Rossa	200.8	3.34%	177.5	2.96%	378.3	6.30%	223.5	9.61%
Scaglia Variegata	1134.7	18.89%	298.9	4.98%	1433.6	23.87%	298.6	12.84%
Maiolica	2726.3	45.39%	802.1	13.35%	3528.4	58.75%	1261.0	54.22%
Rosso Ammonitico	60.8	1.01%	0.0	0.00%	60.8	1.01%	0.0	0.00%
Eocene	179.8	2.99%	12.8	0.21%	192.6	3.21%	49.3	2.12%
Total	**4714.8**	**78.50%**	**1291.3**	**21.50%**	**6006.1**	**100.00%**	**2325.5**	**100.00%**

Table 7.5. Percentage values of cores and core shatters weight according to raw material types.

When comparing percentage values for raw material types displayed in Figures 7.5 (quantity) and 7.6 (weight), little difference is detectable between the two. Most noticeable are discrepancies between weight and numerical quantity percentage values for Maiolica cores (approximately +2 percentage points) and for Eocene ones (ca. +50% from quantity to weight percentage values). However, despite the presence of differences, these are of a slight nature and therefore hold little significance for overall quantification purposes: relationships among different lithotypes are maintained unvaried, i.e. flint from Maiolica formations (58.75%) remains the most abundant raw material type, followed, at a considerable distance, by flint coming from Scaglia Variegata (23.87%) and Scaglia Rossa (6.38%) outcrops.

Feature	Not identifiable		Scaglia Rossa		Scaglia Variegata		Maiolica		Rosso Ammonitico		Eocene		Total
	C	FC	C	FC	C	FC	C	FC	C	FC	C	FC	
Pit A							1						1
Pit D	2		1		1	1	2	2					9
Pit G	2				1		7	3					13
Pit J					4	1	5	8			1		19
Pit K					1		7	1					9
Pit L			1		4	2	9	2				1	19
Pit M						1	1						2
Pit N				1									1
Pit O	1		1	1	7		5	2					17
Pit PQR	2		2	2	3	4	15	3	1				32
Pit S	1				1	1	4	1					8
Pit T						2							2
Pit U					1		1	2					4
Pit V	3				4		11	4	1				23
Pit W	1			2		2	7						12
Pit Z	1		1	1	1		5	4			1		14
Total	**13**	**0**	**6**	**7**	**28**	**14**	**80**	**32**	**2**	**0**	**2**	**1**	**185**

Table 7.6. Distribution of cores according to their lithotype among selected contexts.

Table 7.6 below shows the distribution of cores, according to their raw material types, in relation to contexts. The table displays numerical quantities present in each pit, and differentiates between cores and flake cores. A number of pits (A, M, N, T and U) produced only a small number of cores, i.e. from one to four. It is important to take this latter aspect into consideration when observing Figure 6.30, which visualizes the distribution of raw material among the pits according to core weight.

From a first look at Figure 7.7, regardless of the total core quantity, a recurrent pattern in all pits is the preponderance of flint coming from Maiolica formations. Pit L offers a slightly different picture. While Maiolica cores are numerically the majority, Scaglia Variegata cores weigh more. There is, however, a straightforward explanation for this: pit L contains the heaviest core in the whole assemblage: ID 4455, gr. 352.4, which happens to be a Scaglia Variegata one. Taking into due consideration the impact of this outlier, pit L, similarly to all the other pits is also characterised by the majority of cores belonging to the Maiolica litho-type group. Eocene and Rosso Ammonitico cores are only a few, each of them was found in a different pit. Scaglia Rossa cores (often represented by one individual only) are present in most pits except for pits J, K, S and V.

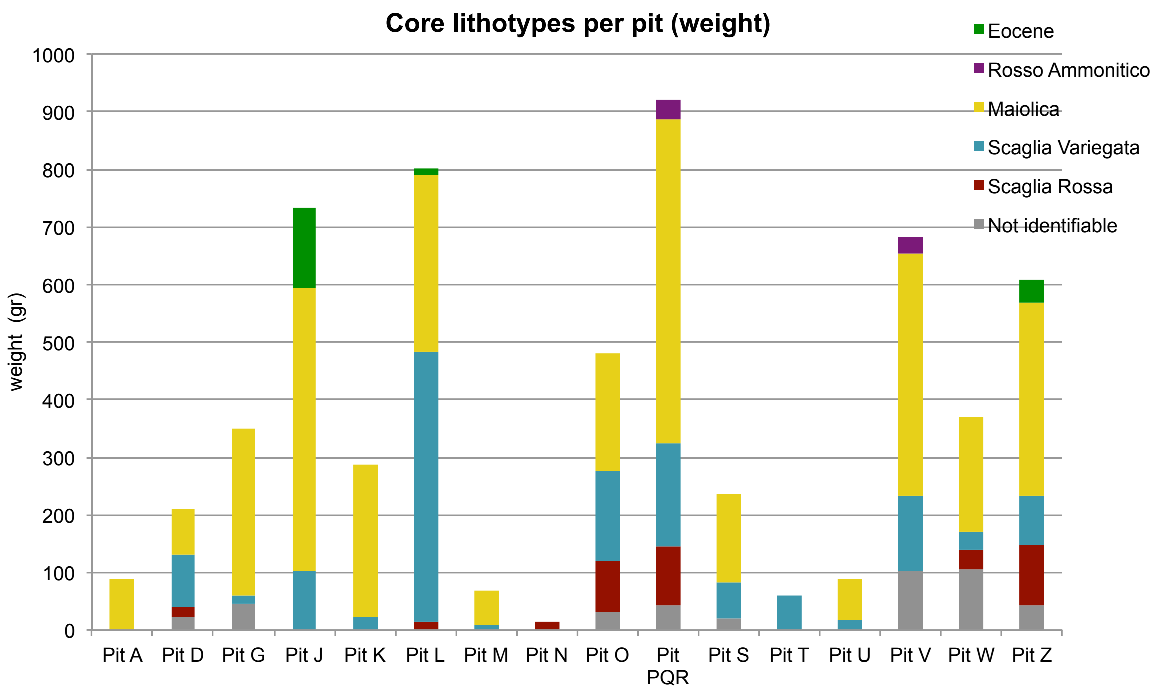


Fig. 7.7. Distribution of cores according to their weight and lithotype among selected contexts.

When looking at the relationship between cores and the entire pit assemblage (retouched and non retouched artefacts) in terms of raw material types, it is interesting to note how the presence or absence of a litho-type at the core stage does not necessarily match with debitage raw material type. This phenomenon is to be linked to secondary deposition at Rocca di Rivoli: pits received knapped material coming from different *chaînes opératoires* taking place at different times. It is therefore plausible to expect the presence of extremely fragmentary *chaînes opératoires*. This characteristic of the assemblage from Rocca di Rivoli was firstly noticed during early attempts at refitting exercises.

When looking at the two distinct archaeological phases, Table 7.7 shows the quantities and weight of cores according to their litho-types. Figures 7.8 and 7.9 represent graphically the proportions of raw material types in the two different assemblages. Cores from the Rivoli Castelnuovo II phase are fewer than those produced by Rivoli Castelnuovo I phase, at the same time, it is immediately noticeable how some lithotypes are completely absent from this knapped artefact category (e.g. Eocene and Rosso Ammonitico).

Lithotypes	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total	
	Qty	Weight	Qty	Weight	Qty	Weight
Non identifiable	9	344.3	4	68.1	13	412.4
Oolitico di San Vigilio						
Scaglia Rossa	12	361	1	17.3	13	378.3
Scaglia Variegata	39	1326.6	3	107	42	1433.6
Maiolica	98	3158.7	14	369.7	112	3528.4
Rosso Ammonitico	2	60.8			2	60.8
Eocene	3	192.6			3	192.6
Total	*163*	*5444*	*22*	*562.1*	*185*	*6006.1*

Table 7.7. Cores lithotypes according to archaeological phase at Rocca di Rivoli.

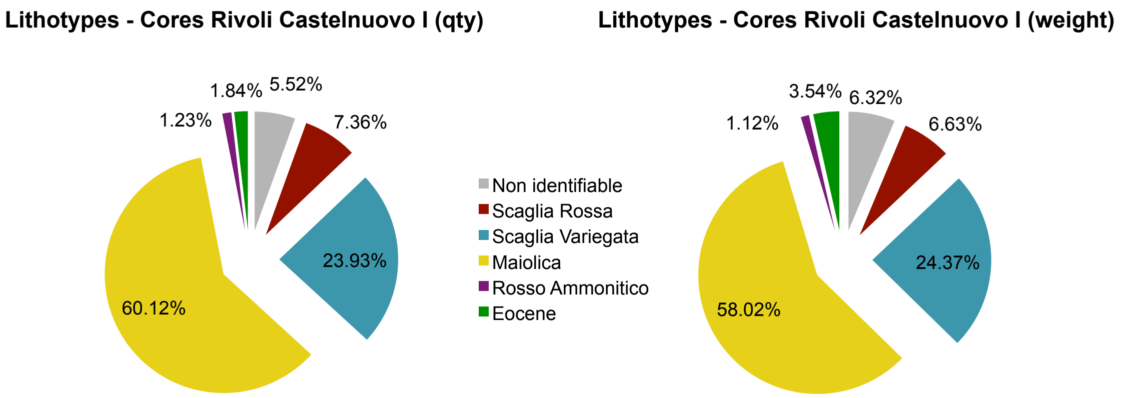


Fig. 7.8. Rivoli Castelnuovo core lithotypes (qty and weight %).

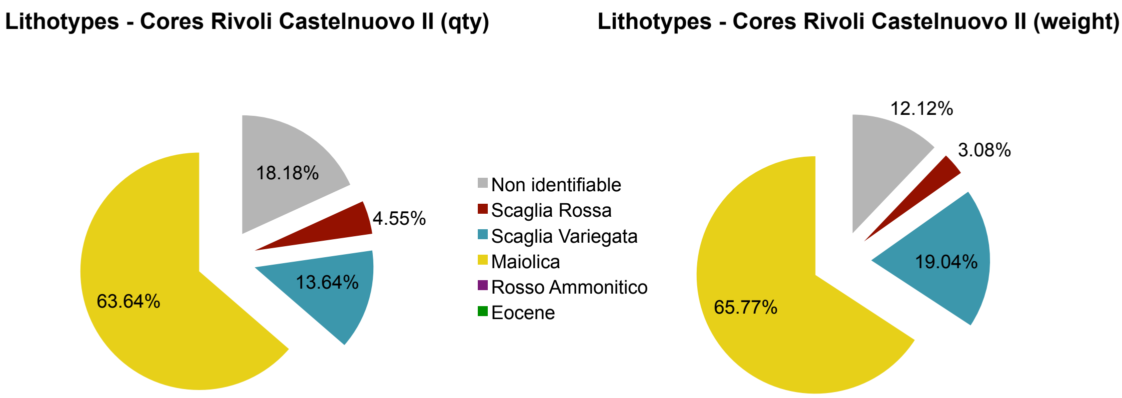


Fig. 7.9. Rivoli Castelnuovo II core lithotypes (quantity and weight %).

Together with lithotype attribution, parent material type identification, including shape and dimensions when available, might supply information on raw material procurement strategies. Chapter 5 highlighted a series of issues as well as shortcomings in the identification of parent material from cortex surviving on cores. Parent material type was inferred from examination (macroscopic and in a few cases microscopic x=10 and x=100) of the cortex left on cores and other artefacts. Unfortunately, only 3 out of 22 cores from Rivoli Castelnuovo II deposits had traces of cortex which provided information about parent material: one Scaglia Rossa core comes from secondary deposits of glacio-fluvial type; a Maiolica core probably comes from a probable nodule extracted from primary outcrops; and a Scaglia Variegata core is likely to have been obtained from a pebble or nodule picked up from a secondary deposit. For cores attributed to the Rivoli Castelnuovo I phase there is additional information. The sample for this phase consists of a total of 163 cores, of which 41 provided information regarding their possible provenance (Tables 7.8 and 7.9).

Parent Material Type	Scaglia Rossa	Maiolica	Scaglia Variegata	Eocene	Not Identifiable	Total	Total %
Pebble glacio-fluvial Secondary Depositis	1	3	7			*11*	*27%*
Pebble/nodule Secondary Deposits	4	11	5			*20*	*49%*
Pebble/nodule Secondary Deposits TERRA ROSSA		2				*2*	*5%*
Nodule Primary Outcrops							
Block Primary Outcrops		5	1	1	1	*8*	*20%*
Total	*5*	*21*	*13*	*1*	*1*	*41*	*100%*

Table 7.8. Distribution of cores according to raw material and parent material (quantities), Rivoli Castelnuovo I.

Parent Material Type	Scaglia Rossa	Maiolica	Scaglia Variegata	Eocene	Not Identifiable	Total	Total %
Pebble glacio-fluvial Secondary Depositis	20.0	112.4	197.7			*330.1*	*24%*
Pebble/nodule Secondary Deposits	89.1	466.2	121.3			*676.6*	*49%*
Pebble/nodule Secondary Deposits TERRA ROSSA		78.1				*78.1*	*6%*
Nodule Primary Outcrops							
Block Primary Outcrops		233.5	18.0	12.8	25.3	*289.6*	*21%*
Total	*109.1*	*890.2*	*337.0*	*12.8*	*25.3*	*1374.4*	*100%*

Table 7.9. Distribution of cores according to raw material and parent material (weight), Rivoli Castelnuovo I.

When looking closer at the 141 cores for which parent material could not be identified, approximately 38% (54 individuals) do not have any cortex; and most of the remaining cores (81 out of 87 cores) show cortex varying between less than 5% and 25% of the entire core surface. This latter data is difficult to make sense of without a rough idea of the core surface taken into consideration. However, as this would become too complicated and time consuming to investigate, it will suffice here to highlight a series of factors which have affected parent material determination, in addition to the lack of corticated surfaces and thermal alteration, such as:

1. Core dimensions: at times even a 75% amount of cortex might come down to a couple of square centimeteres. In order to have a rough idea of core dimensions both core measurements and weight provide a failry good indicator of core size.

2. Alteration due to preservation and conservation conditions: both post-depositional factors and post-excavation treatment contribute to alteration of corticated areas e.g. by means of abrasion during flint washing, or staining or erosion whilst buried in the soil.
3. Knapping techniques: cortex might have been abraded or partially removed, in both instances chances of attributing parent material are drastically reduced.
4. Analyst having difficulties in attributing parent material categories confidently.

All of the above-mentioned issues have undoubtedly affected corticated cores interpretation. Nonetheless, the remaining 44 cores provide information that is worth looking to closely. The majority of cores have been identified as coming from raw material collected from secondary deposits, such as natural accumulations at valley bottoms and within *terra rossa* deposits; or carried by rivers and streams (collected from river banks, gullies or gorges in the mountains or hills). This latter category does not include morainic deposits which are a characteristic of the Rivoli landscape. No core cortex could be attributed to such deposits for reasons fully explained in Chapter 5 (i.e. inability to collect any flint sample from morainic accumulations dotted around Rivoli, and total absence of reference to this type of find in the available literature).

When looking at individual raw material categories, it seems clear that most cores (with the exception of small numbers of Rosso Ammonitico and Eocene examples), are represented by parent material associated with secondary deposits. Maiolica cores are the only ones with red-stained cortex associated with *terra rossa* secondary deposits. Finally, as regards parent material characteristics, Tables 7.10 and 7.11 take a closer look to dimension and shape of all the 44 cores.

Parent Material Shape	Pebble glacio-fluvial Secondary Depositis	Pebble/ nodule Secondary Deposits	Pebble/ nodule Terra Rossa	Nodule Primary Outcrops	Block Primary Outcrops	Tot.	Tot. %
Not identifiable	2	2			1	5	11.36%
Angular				1	4	5	11.36%
Sub-angular		8	1		3	12	27.27%
Rounded	4	3				7	15.91%
Sub-rounded	6	8	1			15	34.09%
Total	**12**	**21**	**2**	**1**	**8**	**44**	**100.00%**

Table 7.10. Percentages of parent material shape according to parent material type (quantity).

Parent Material Dimensions	Pebble glacio-fluvial Secondary Depositis	Pebble/ nodule Secondary Deposits	Pebble/ nodule Terra Rossa	Nodule Primary Outcrops	Block Primary Outcrops	Tot.	Tot. %
Not identifiable	3	6		1		10	22.73%
Small <5cm	4	5			2	11	25.00%
Medium 5-10 cm	4	9	2		6	21	47.73%
Large >10cm	1	1				2	4.55%
Total	**12**	**21**	**2**	**1**	**8**	**44**	**100.00%**

Table 7.11. Percentages of parent material dimension categories according to parent material (quantity).

For 23 of the 31 Rivoli Castelnuovo II flake cores it was also possible to determine the approximate original dimensions of their parent material. For the majority (52%) parent material appears to be medium-sized (5 to 10cm), whereas the remaining 47% was classified as small (<5cm), and only one example was found to come from material larger than 10cm.

Debitage

Tables 7.12 and 7.13 show litho-type distribution for the debitage category (flakes and blades) in relation to the archaeological phases at the site.

Lithotype	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Flake Debitage Total	
	Qty	Weight	Qty	Weight	Qty	Weight
Non identifiable	297	714.3	73	238.8	370	953.1
Oolitico di San Vigilio	21	113.4	2	3.4	23	116.8
Scaglia Rossa	186	626	14	52.9	200	678.9
Scaglia Variegata	521	1871.8	95	380.7	616	2252.5
Maiolica	2155	6585.8	285	1002.7	2440	7588.5
Rosso Ammonitico	3	9.6	0	0	3	9.6
Eocene	43	244.4	8	22.8	51	267.2
Total	*3226*	*10165.3*	*477*	*1701.3*	*3703*	*11866.6*

Table 7.12. Flake lithotype distribution in relation to the two occupational phases at Rocca di Rivoli.

Lithotype	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Blades Debitage Total	
	Qty	Weight	Qty	Weight	Qty	Weight
Non identifiable	79	130.5	32	63.3	111	193.8
Oolitico di San Vigilio	2	3.2	0	0	2	3.2
Scaglia Rossa	33	58.2	5	9.1	38	67.3
Scaglia Variegata	194	407	33	45.8	227	452.8
Maiolica	675	1343.1	137	184.2	812	1527.3
Rosso Ammonitico	1	31.8	0	0	1	31.8
Eocene	17	30.8	1	10.4	18	320.32
Total	*1001*	*2004.6*	*208*	*312.8*	*1209*	*2596.52*

Table 7.13. Blade lithotype distribution in relation to the two occupational phases at Rocca di Rivoli.

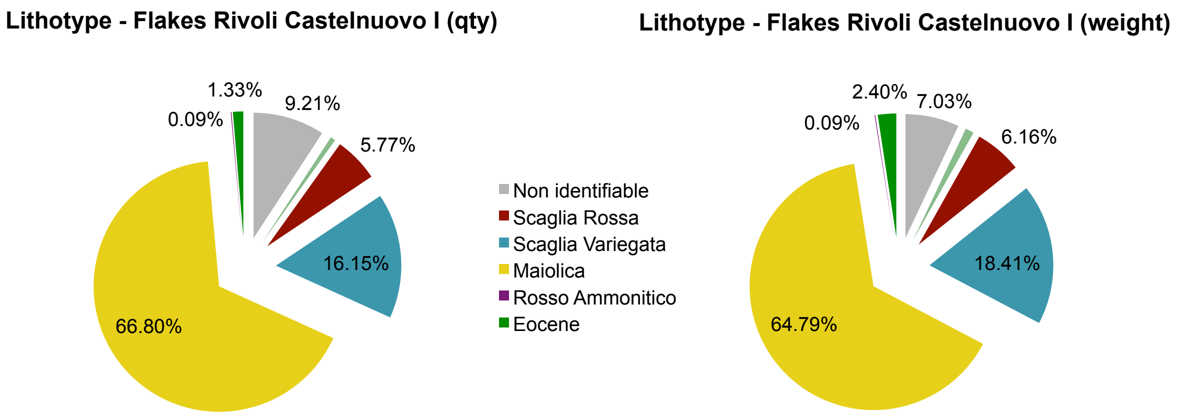


Fig. 7.10. Percentage values of flake lithotypes coming from Rivoli Castelnuovo I occupational phases (numerical quantities).

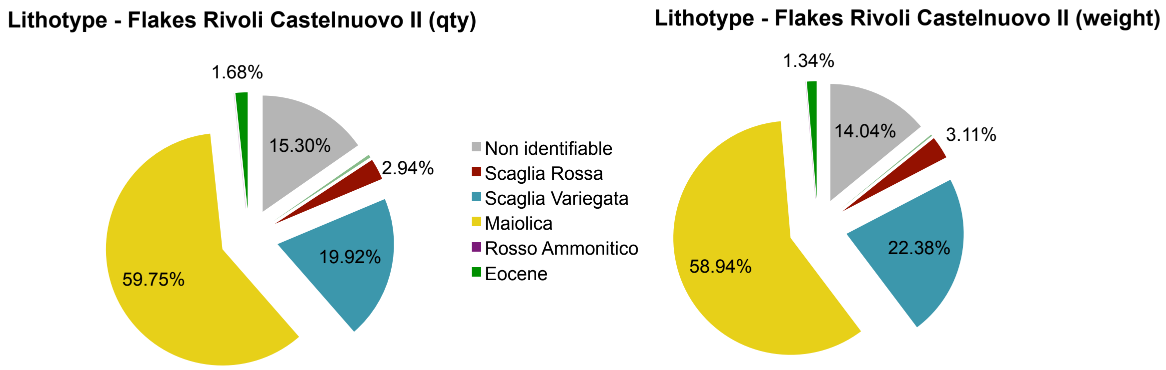


Fig. 7.11. Percentage values of flake lithotypes coming from Rivoli Castelnuovo II occupational phases.

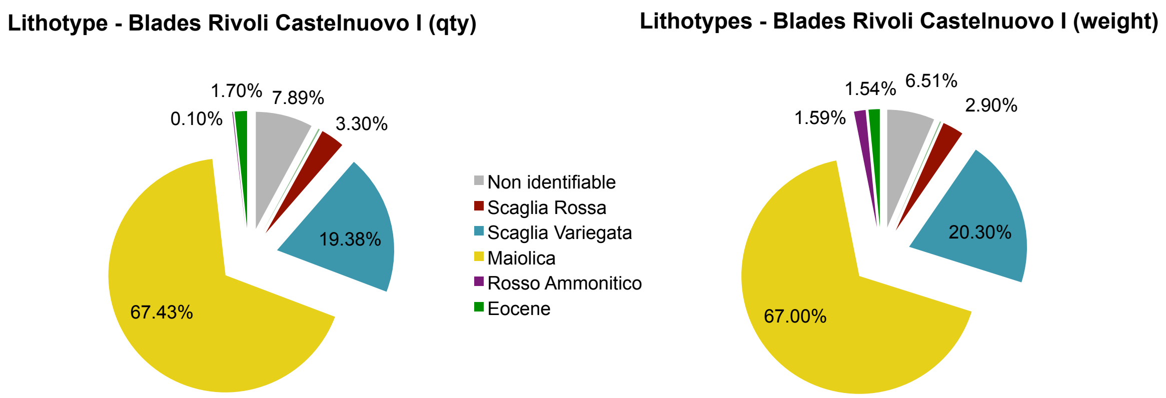


Fig. 7.12. Percentage values of blade lithotypes coming from Rivoli Castelnuovo I occupational phases.

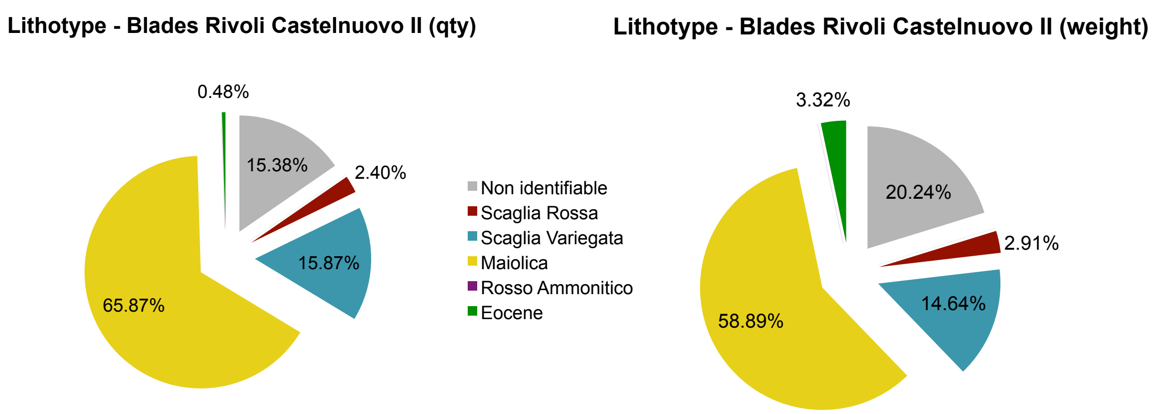


Fig. 7.13. Percentage values of blade lithotypes coming from Rivoli Castelnuovo II occupational phases.

Litho-type percentages (numerical quantities and weight respectively) of blade and flake debitage from the two different occupation phases are shown in Figures 7.10 to 7.13. Flint coming from the Maiolica rock formation is without doubt the preponderant litho-type in both occupational phases and debitage categories. Scaglia Variegata remains the second most common raw material. It is interesting to notice that there is a slight increase (just over 3% for numerical quantities and just over 4% weight wise) in the employment of Scaglia Variegata for the knapping of flakes in the Rivoli Castelnuovo II phase. Whereas flint coming from Eocene formation continues to be present in the later Rivoli Castelnuovo II occupational phase, raw material such as Oolitico di San Vigilio and Rosso Ammonitico (already rare in the Rivoli Castelnuovo I flake assemblage) disappear almost completely (with only 2 pieces belonging to the Oolitico di San Vigilio rock formation and none of the Rosso Ammonitico). Another aspect worth pointing out is the increase in unidentifiable artefacts: these have increased by 5 percentage points in the Rivoli Castelnuovo II flakes (from 9.21% in the earlier phase to 15.30% in the later one as regards numerical quantities and from 7.03% to 14.04% in terms of weight values). This pattern repeats itself also for the blade category in an even more marked way: from 7.89% in the Rivoli Castelnuovo I assemblage to 15.38% in the Rivoli Castelnuovo II (numerical quantities), and from 6.51% to 20.24% respectively (weight values). When looking at the blade assemblage, here again Maioilica represents the most common raw material, followed at some distance by Scaglia Variegata. Although the incidence of both lithotypes varies from one assemblage to the other, the most noticeable difference has to do with the complete absence of Rosso Ammonitico and Oolitico di San Vigilio lithotypes (already rare in the Rivoli Castelnuovo I assemblage) in the later occupation phase of Rivoli Castelnuovo II. The latter phase has only one piece coming from the Eocene rock formation, against the 17 identified in the blade assemblage coming from the Rivoli Castelnuovo I phase.

It is possible to add further information to some of the patterns just described, in particular to the increase in unidentified artefacts between the earlier and later stages of occupation. When looking at possible reasons for the lack of this type of data, it is immediately noticeable how both thermal alteration and cortex percentage play a considerable part: Tables 7.14 and 7.15 explore reasons for the lack of identification for both assemblages.

Reasons for non-identifiable lithotype	Rivoli Castelnuovo I				Rivoli Castelnuovo II			
	Qty	%	Weight	%	Qty	%	Weight	%
Thermal alteration	218	73.40%	559.8	69.97%	40	54.79%	149.8	62.73%
Cortex (25% +)	18	6.06%	42.9	5.36%	5	6.85%	13.9	5.82%
NA	61	20.54%	197.4	24.67%	28	38.36%	75.1	31.45%
Total	*297*	*100.00%*	*800.1*	*100.00%*	*73*	*100.00%*	*238.8*	*100.00%*

Table 7.14. Reasons for lack of raw material attribution for flake debitage.

Reasons for non-identifiable lithotype	Rivoli Castelnuovo I				Rivoli Castelnuovo II			
	Qty	%	Weight	%	Qty	%	Weight	%
Thermal alteration	58	73.42%	111	85.06%	26	81.25%	50.9	80.41%
Cortex (25% +)	2	2.53%	3.7	2.84%	1	3.13%	4.8	7.58%
NA	19	24.05%	15.8	12.11%	5	15.63%	7.6	12.01%
Total	*79*	*100.00%*	*130.5*	*100.00%*	*32*	*100.00%*	*63.3*	*100.00%*

Table 7.15. Reasons for lack of raw material attribution for blade debitage.

The vast majority of unidentified debitage is due to thermal alteration: pieces are either burnt or have undergone some form of thermal alteration preventing the original characteristics of the raw material to be attributed with confidence. Corticated debitage also plays a role, although very few are debitage artefacts which, being spared from burning or other thermal treatment, present large portions covered in cortex as to pose an obstacle in identifying the lithotype the material is coming from.

Figures 7.14 and 7.15, along with Tables 7.16 and 7.17 show the relationship between raw material and Bagolini's (1968) debitage categories. In addition to the differences between the assemblages already explored above, it can again be seen how the range of lithotypes diminishes in the later deposits, such as flint coming from the Scaglia Rossa formation, decreases substantially during the Rivoli Castelnuovo II phase. As previously pointed out, flint coming from Scaglia Variegata is more common in this phase, as is the quantity of non-identifiable debitage pieces.

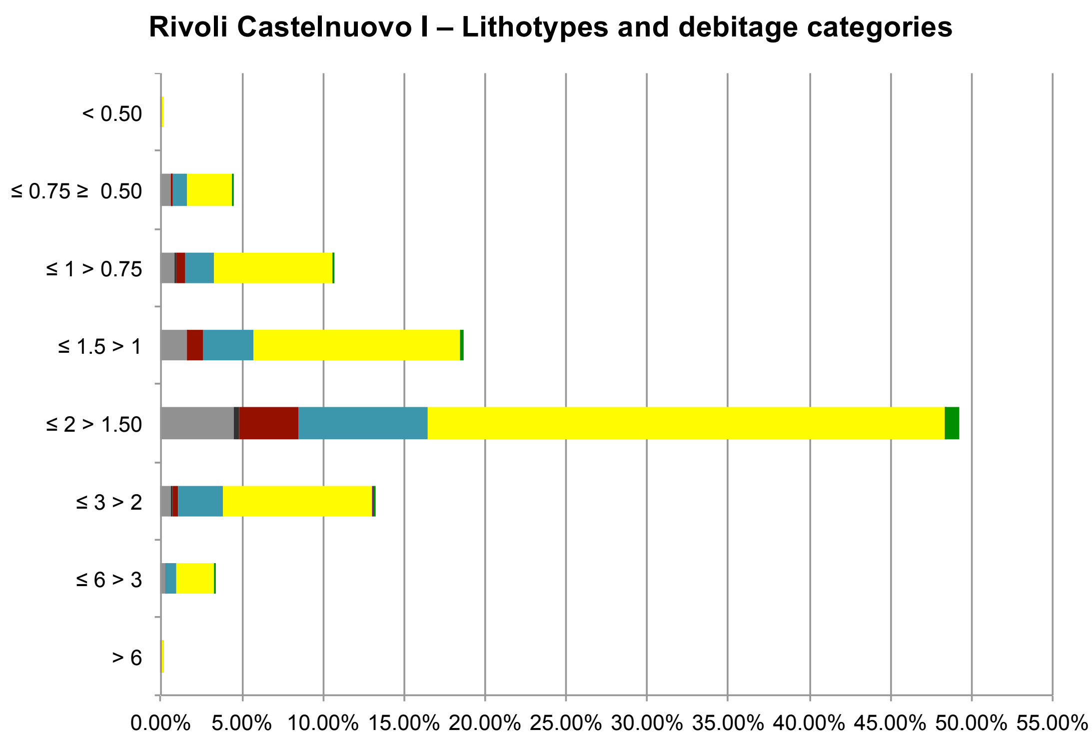


Fig. 7.14. Rivoli Castelnuovo I. Lithotype distribution according to Bagolini (1968) debitage categories (numerical quantities, complete pieces only).

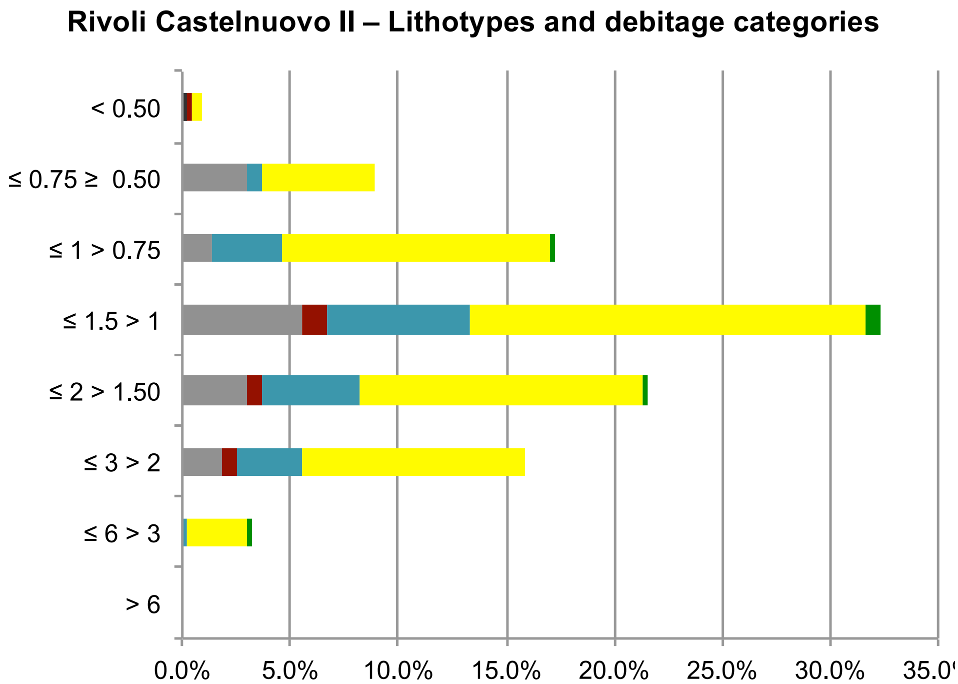


Fig. 7.15. Rivoli Castelnuovo II debitage. Lithotype distribution according to Bagolini's artefact categories. (numerical quantities, complete individuals only).

Debitage categories	Non Identifiable	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Total
> 6			1	2	3			6
≤ 6 > 3	7		3	20	70		4	104
≤ 3 > 2	20	1	13	83	286	1	4	408
≤ 2 > 1.50	139	10	112	247	982	2	27	1519
≤ 1.5 > 1	48	3	31	93	395		6	576
≤ 1 > 0.75	26	2	19	55	223	1	5	331
≤ 0.75 ≥ 0.50	18	1	4	26	86		1	136
< 0.50	2				2			4
Total	*260*	*17*	*183*	*526*	*2047*	*4*	*47*	*3084*

Table 7.16. Rivoli Castelnuovo I. Lithotype distribution according to Bagolini's (1968) debitage categories (numerical quantities, complete pieces only).

Debitage categories	Non Identifiable	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Total
> 6								
≤ 6 > 3				1	12		1	14
≤ 3 > 2	8		3	13	45			69
≤ 2 > 1.50	13		3	20	57		1	94
≤ 1.5 > 1	24		5	29	80		3	141
≤ 1 > 0.75	6			14	54		1	75
≤ 0.75 ≥ 0.50	13			3	23			39
< 0.50		1	1		2			4
Total	*64*	*1*	*12*	*80*	*273*		*6*	*436*

Table 7.17. Rivoli Castelnuovo II. Lithotype distribution according to Bagolini's (1968) debitage categories (numerical quantities, complete pieces only).

Only a tiny percentage of debitage could be attributed to a parent material category (Tables 7.18 to 7.19). The data collected, however, confirm patterns identified in the core assemblage (see above). The main difference in terms of flakes between the two phases is the increase during the Rivoli Castelnuovo II phase of flakes with cortex displaying the characteristic brownish-red stains associated with *terra rossa* deposits.

RCI Flake Debitage Parent Material	Qty	%	Weight	%
Non identifiable	2983	92.5%	8375.7	82.4%
Pebble glacio-fluvial Secondary Depositis	21	0.7%	256	2.5%
Pebble/nodule Secondary Deposits	97	3.0%	640.7	6.3%
Pebble/nodule Secondary Deposits TERRA ROSSA	95	2.9%	573.1	5.6%
Nodule Primary Outcrops	12	0.4%	102.8	1.0%
Block Primary Outcrops	18	0.6%	217	2.1%
Total	*3226*	*100.0%*	*10165.3*	*100.0%*

Table 7.18. Rivoli Castelnuovo I flake debitage. Parent material distribution.

RCII Flake Debitage Parent Material	Qty	%	Weight	%
Non identifiable	432	90.6%	1465.1	86.1%
Pebble glacio-fluvial Secondary Depositis	1	0.2%	8.5	0.5%
Pebble/nodule Secondary Deposits	13	2.7%	81	4.8%
Pebble/nodule Secondary Deposits TERRA ROSSA	22	4.6%	103.6	6.1%
Nodule Primary Outcrops	2	0.4%	14.2	0.8%
Block Primary Outcrops	7	1.5%	28.9	1.7%
Total	*477*	*100.0%*	*1701.3*	*100.0%*

Table 7.19. Rivoli Castelnuovo II flake debitage. Parent material distribution.

When looking at the percentage values of identified parent material for flake debitage, proportions change slightly (Fig. 7.16): flint coming from secondary deposits diminishes, whereas flint derived from glacio-fluvial and *terra rossa* deposits increases considerably. Another interesting variation is the increase of flint cming from primary outcrops (blocks).

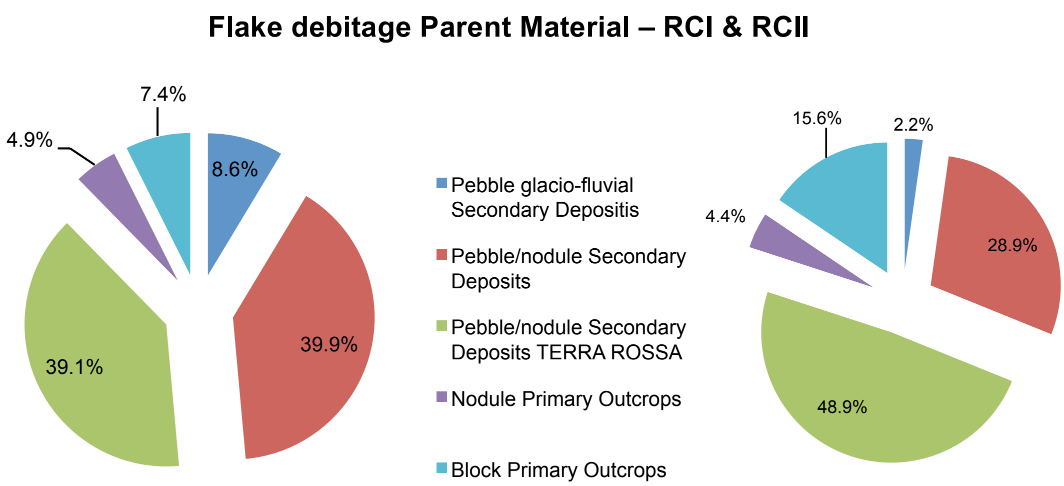


Fig. 7.16. Flake debitage parent material from identified artefacts coming from Rivoli Castelnuovo I (left) and Rivoli Castelnuovo II (right) deposits.

Data relating to blade debitage parent material is scantier, especially for the Rivoli Castelnuovo II phase in which 95% debitage pieces are unidentified. In addition to Tables 7.20 and 7.21, Figure 7.17 provides a rough idea of the proportions of parent material when it comes to identified pieces only. At the same time, we need to keep in mind that results relating to the later deposits come from only 9 pieces out of 208. When comparing data on identified blades to previous information on flake debitage it is immediately clear how in the later archaeological phase parent material associated with primary outcrops is more frequent and how flint coming from *terra rossa* deposits displays a lower incidence.

RCII Blade Debitage Parent Material	Qty	%	Weight	%
Non identifiable	199	95.7%	281.3	89.9%
Pebble glacio-fluvial Secondary Depositis				
Pebble/nodule Secondary Deposits	4	1.9%	16.3	5.2%
Pebble/nodule Secondary Deposits TERRA ROSSA	2	1.0%	2.4	0.8%
Nodule Primary Outcrops				
Block Primary Outcrops	3	1.4%	12.8	4.1%
Total	*208*	*100.0%*	*312.8*	*100.0%*

Table 7.20. Rivoli Castelnuovo II blade debitage. Parent material distribution.

RCI Blade Debitage Parent Material	Qty	%	Weight	%
Non identifiable	156	75.0%	1804	90.0%
Pebble glacio-fluvial Secondary Depositis	1	0.5%	3.4	0.2%
Pebble/nodule Secondary Deposits	19	9.1%	80.2	4.0%
Pebble/nodule Secondary Deposits TERRA ROSSA	23	11.1%	78.1	3.9%
Nodule Primary Outcrops				
Block Primary Outcrops	9	4.3%	38.9	1.9%
Total	*208*	*100.0%*	*2004.6*	*100.0%*

Table 7.21. Rivoli Castelnuovo I blade debitage. Parent material distribution.

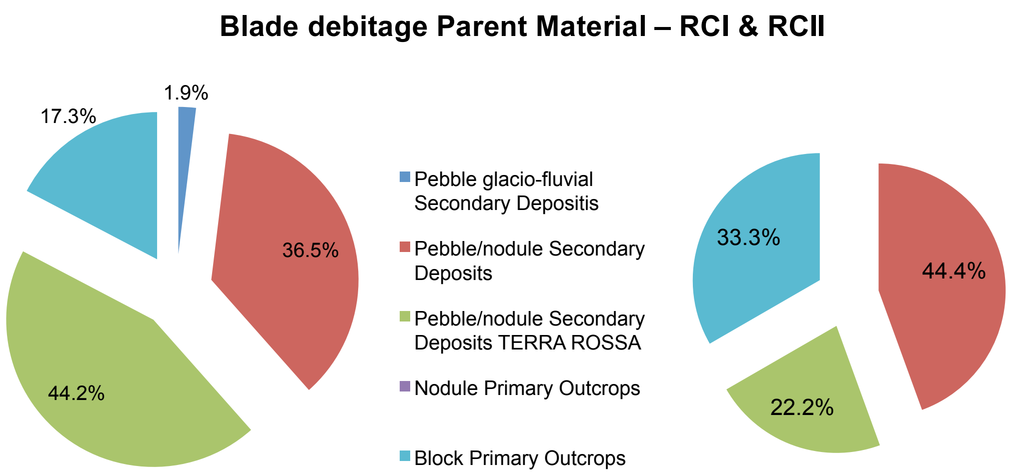


Fig. 7.17. Blade debitage parent material from identified artefacts coming from Rivoli Castelnuovo I (left) and Rivoli Castelnuovo II (right) deposits.

Tables 7.22 and 7.23 look at debitage parent material subdivided into Bagolini's (1968) artefact categories. Again, despite the disparity in quantifiable data between the two archaeological phases, it is interesting to note how during the Rivoli Castelnuovo II phase a larger percentage of flint seems to be coming from primary outcrops (approximately 24% of the identified Rivoli Castelnuovo II assemblage against 12% of Rivoli Castelnuovo I). Both phases however seem to point at secondary deposits (including *terra rossa*) as the main procurement sources (approximately 75% and 87% of the identified Rivoli Castelnuovo II and Rivoli Castelnuovo I assemblages respectively). Flint coming from glacio-fluvial outcrops is represented by only one piece in the later Rivoli Castelnuovo II phase (overall representing 2.2% over a 7% of the Rivoli Castelnuovo I incidence).

Debitage categories	Pebble glacio-fluvial Secondary Depositis	Pebble/nodule Secondary Deposits	Pebble/nodule Secondary Deposits TERRA ROSSA	Nodule Primary Outcrops	Block Primary Outcrops	Total	Total RC I debitage (complete)
> 6							6
≤ 6 > 3		2	3			5	104
≤ 3 > 2	1	14	11	4		30	408
≤ 2 > 1.50	7	50	60	5	6	128	1519
≤ 1.5 > 1	6	19	14	1	4	44	576
≤ 1 > 0.75	3	9	5	1	4	22	331
≤ 0.75 ≥ 0.50		3	6	2	3	14	136
< 0.50							4
Total	*17*	*97*	*99*	*13*	*17*	*243*	*3084*

Table 7.22. Rivoli Castelnuovo I. Parent material distribution according to Bagolini's (1968) debitage categories (numerical quantities, complete pieces only).

Debitage categories	Pebble glacio-fluvial Secondary Depositis	Pebble/nodule Secondary Deposits	Pebble/nodule Secondary Deposits TERRA ROSSA	Nodule Primary Outcrops	Block Primary Outcrops	Total	Total RC II debitage (complete)
> 6							
≤ 6 > 3					1	1	14
≤ 3 > 2		3	1		1	5	69
≤ 2 > 1.50	1	2	3		2	8	94
≤ 1.5 > 1		3	10	1	1	15	141
≤ 1 > 0.75		4	5	1	2	12	75
≤ 0.75 ≥ 0.50			1	2		3	39
< 0.50			1			1	4
Total	*1*	*12*	*21*	*4*	*7*	*45*	*436*

Table 7.23. Rivoli Castelnuovo II. Parent material distribution according to Bagolini's (1968) debitage categories (numerical quantities, complete pieces only).

Debris

Table 7.24 shows raw material type for the debris category. The majority of debris were not attributed a raw material mostly due to their being burnt or thermally altered (39% of Rivoli Castelnuovo I and 52% of Rivoli Castelnuovo II assemblages respectively). However, when comparing figures in Table 7.24 and as displayed by the pie charts of Figures 7.18 and 7.19, debris coming form Rivoli Castelnuovo I show a wider variety of raw material than those coming from the later phase. It is also interesting to note how raw material different from flint was recorded for this artefact category (such as quartz and limestone) during Rivoli Castelnuovo I.

Parent material information coming from debris is again of little significance statistically. Only 2.43% of the Rivoli Castelnuovo I debris were attributed a parent material (37 pieces in total) and the majority of these came from secondary deposits (86%, with 2 coming from fluvial deposits, 10 from secondary outcrops and 20 from the distinct *terra rossa* deposits). Only a very small percentage (14%: 5 pieces in total) came from primary outcrops. Data collected for the debris material coming from Rivoli Castelnuovo II deposits are even scantier and again the majority comes from secondary outcrops (10 out of 12).

Lithotype	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Debris Total	
	Qty	Weight	Qty	Weight	Qty	Weight
Non identifiable	665	2400.3	301	627.9	966	3028.2
Oolitico di San Vigilio	4	7.3			4	7.3
Scaglia Rossa	47	294.3	9	91.7	56	386
Scaglia Variegata	220	839.3	51	226.4	271	1065.7
Maiolica	570	2320.8	112	376	682	2696.8
Rosso Ammonitico						
Eocene	11	65	2	5.2	13	70.2
Other	5	26.8			5	26.8
Total	*1522*	*5953.8*	*475*	*1327.2*	*1997*	*7281.0*

Table 7.24. Lithotype distribution among debris between the two main occupation phases at Rocca di Rivoli.

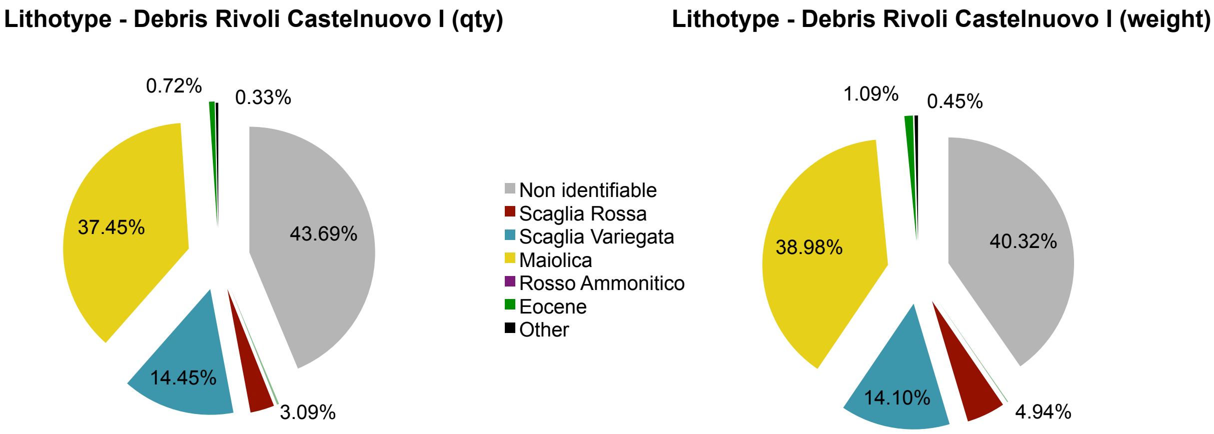


Fig. 7.18. Raw material composition of Rivoli Castelnuovo I debris assemblage.

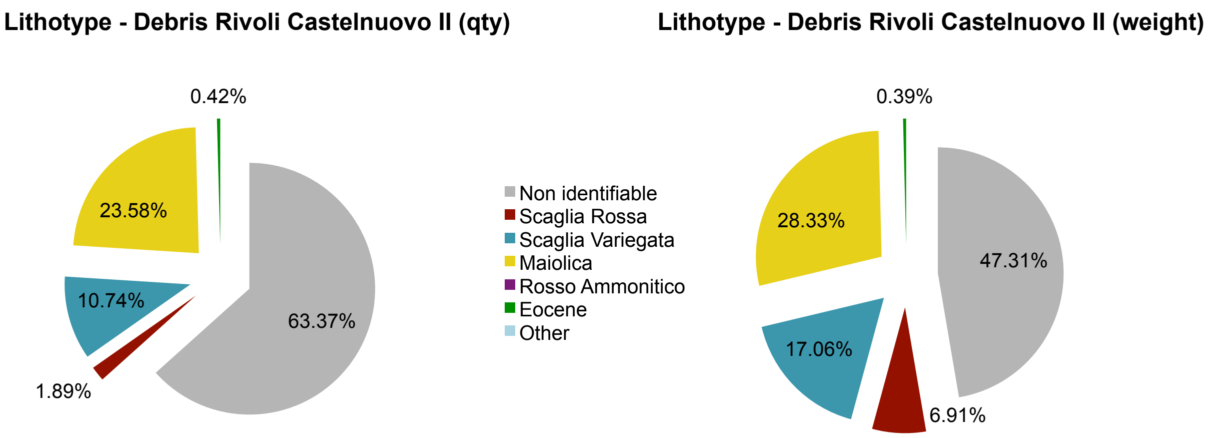


Fig. 7.19. Raw material composition of Rivoli Castelnuovo II debris assemblage.

Retouched artefacts

Patterns emerging from Tables 7.25 and 7.26 displaying lithotype distribution for the retouched artefacts at Rocca di Rivoli repeat the trends already noticed for cores and debitage: some raw materials present (although in small quantities) within the Rivoli Castelnuovo I retouched assemblage are totally absent (Rosso Ammonitico for flakes and blades, and Oolitico di San Vigilio and Eocene for blades), or are represented by only one ipiece in the subsequent phase Rivoli Castelnuovo II (e.g. Oolitico di San Vigilio and Scaglia Rossa for flakes, and Scaglia Rossa for blades).

Lithotype	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total Retouched Flakes	
	Qty	Weight	Qty	Weight	Qty	Weight
Non identifiable	51	271.6	13	65.2	64	336.8
Oolitico di San Vigilio	2	28.4	1	25.9	3	54.3
Scaglia Rossa	40	201.2	1	5.1	41	206.3
Scaglia Variegata	126	913.4	38	162.6	164	1076
Maiolica	418	2485.1	107	672.1	525	3157.2
Rosso Ammonitico	1	2.2			1	2.2
Eocene	20	108.4	4	34.1	24	142.5
Total	*658*	*4010.3*	*164*	*965*	*822*	*4975.3*

Table 7.25. Retouched flakes lithotypes distribution in relation to archaeological phases at Rocca di Rivoli.

Lithotype	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total Retouched Blades	
	Qty	Weight	Qty	Weight	Qty	Weight
Non identifiable	12	29	11	23	23	52
Oolitico di San Vigilio	2	11.2			2	11.2
Scaglia Rossa	10	30.3	1	2.5	11	32.8
Scaglia Variegata	47	189	16	76.1	63	265.1
Maiolica	170	596.3	53	198.8	223	795.1
Rosso Ammonitico	1	7.2			1	7.2
Eocene	8	42.2			8	42.2
Total	*250*	*905.2*	*81*	*300.4*	*331*	*1205.6*

Table 7.26. Retouched blades lithotypes distribution in relation to archaeological phases at Rocca di Rivoli.

The varying incidence of the different lithotypes from one phase to the other is clearly shown in Figures 7.20 to 7.23. Flint from the Maiolica outcrops remains the most important raw material throughout both phases and in both assemblages, with a slight increase for Rivoli Castelnuovo II retouched flakes and a slight decrease for Rivoli Castelnuovo II blades. It is interesting to note how quantity and weight percentage values behave slightly different for retouched blades: quantity-wise, retouched blades of flint coming from Maiolica outcrops decrease during Rivoli Castelnuovo II phase but their weight value increases. This phenomenon repeats itself when looking at flint coming from Scaglia Variegata outcrops: we see an increase in the quantity of Rivoli Castelnuovo II retouched flakes of this raw material (from 19.15% in RCI to 23.17%) but a decrease when looking at their weight (from 22.87% to 16.85%). This phenomenon, which might be linked to different raw material management during the knapping process, will be explored further below.

The charts below (Figs. 7.20 to 7.23) show the loss of the varied repertoire of raw material types characterising Rivoli Castelnuovo I phase when compared to the more recent Rivoli Castelnuovo II phase.

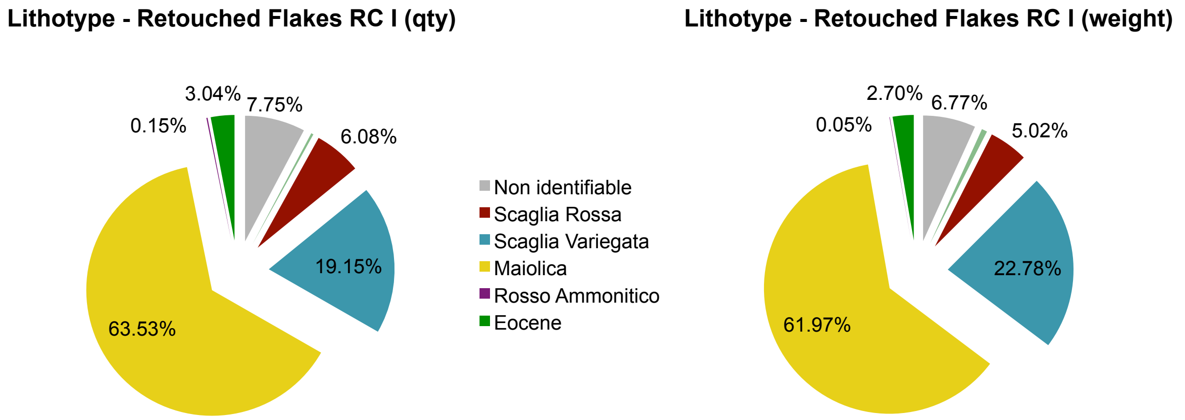


Fig. 7.20. Rivoli Castelnuovo I retouched flakes lithotypes.

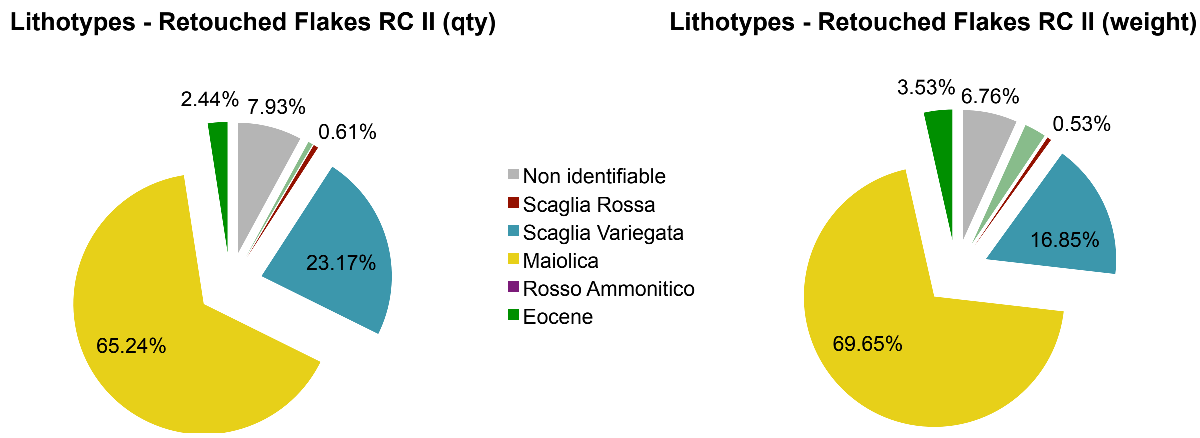


Fig. 7.21. Rivoli Castelnuovo II retouched flakes lithotypes.

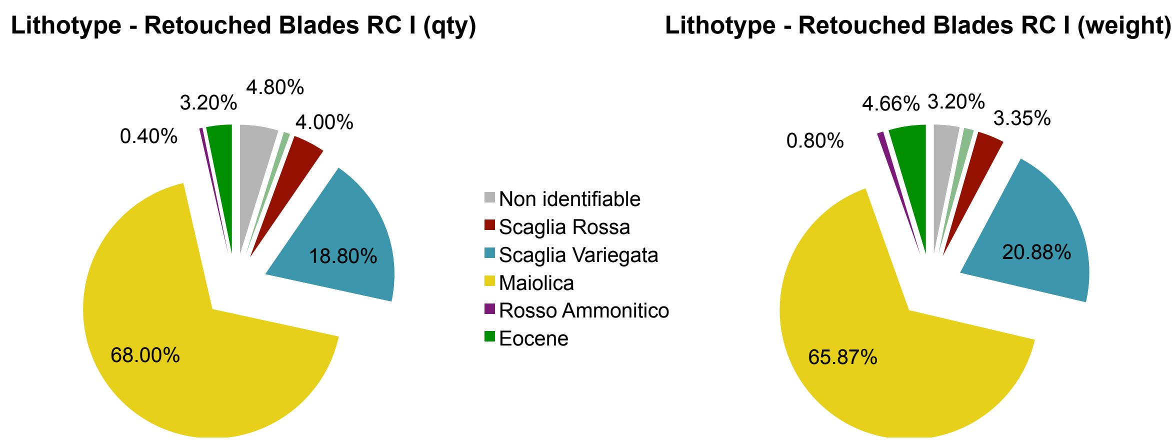


Fig. 7.22. Rivoli Castelnuovo I retouched blades lithotypes.

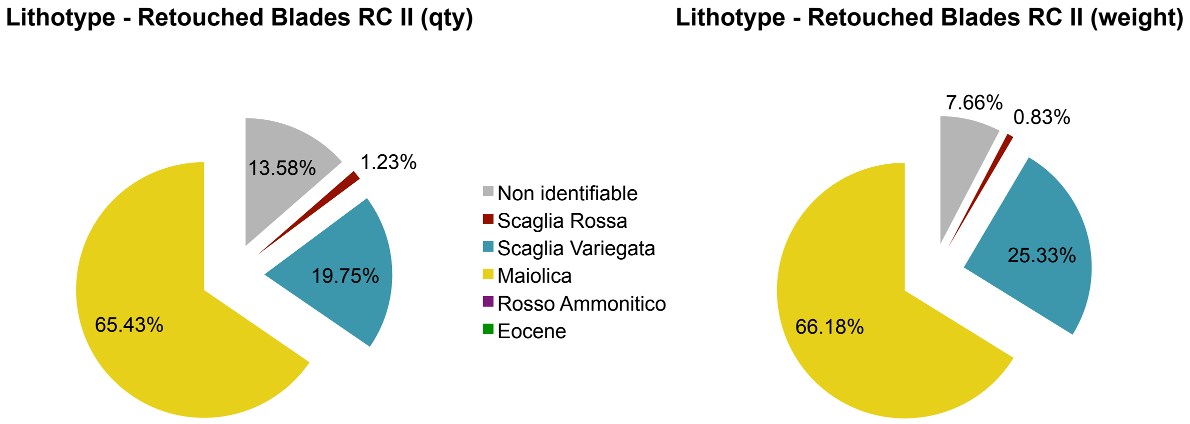


Fig. 7.23. Rivoli Castelnuovo II retouched blades lithotypes.

The main reasons for the lack of raw material attribution for retouched flakes and blades respectively are summarised in Tables 7.27 and 7.28. Again, thermal modification is responsible for the majority of unidentifiable raw material.

Reasons for non-identifiable lithotype	Rivoli Castelnuovo I				Rivoli Castelnuovo II			
	Qty	%	Weight	%	Qty	%	Weight	%
Thermal alteration	41	80.39%	181.6	66.86%	13	100.00%	65.2	100.00%
Cortex (25% +)	2	3.92%	36.7	13.51%				
NA	8	15.69%	53.3	19.62%				
Total	*51*	*100.00%*	*271.6*	*100.00%*	*13*	*100.00%*	*65.2*	*100.00%*

Table 7.27. Reasons for lack of raw material attribution for retouched flakes.

Reasons for non-identifiable lithotype	Rivoli Castelnuovo I				Rivoli Castelnuovo II			
	Qty	%	Weight	%	Qty	%	Weight	%
Thermal alteration	11	91.67%	27.2	93.79%	11	100.00%	23	100.00%
Cortex (25% +)								
NA	1	8.33%	1.8	6.21%				
Total	*12*	*100.00%*	*29*	*100.00%*	*11*	*100.00%*	*23*	*100.00%*

Table 7.28. Reasons for lack of raw material attribution for retouched blades.

When looking at the retouched assemblage through the artefact categories proposed by Bagolini (1968) (Tables 7.29 and 7.30 and Figures 7.24 and 7.25), it is immediately clear that flint coming from the Maiolica makes up the majority (66.1%) of both assemblages, followed at some distance by Scaglia Variegata: 19.6% and 24.1% of Rivoli Castelnuovo I and II assemblages respectively. Raw material coming from Scaglia Rossa formations represents 6.1% and 1.8% of Rivoli Castelnuovo I and II assemblages respectively.

Parent material information for retouched artefacts is scanty, especially for Rivoli Castelnuovo II phase. The same reasons previously put forward can be held responsible for the lack of parent material attribution as shown in Tables 7.31 to 7.34.

Debitage categories	Non Identifiable	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Total
> 6			1		1			2
≤ 6 > 3	2			9	27			38
≤ 3 > 2	6		7	22	73	1	7	116
≤ 2 > 1.50	4		10	28	91		9	142
≤ 1.5 > 1	10	1	11	31	117		3	173
≤ 1 > 0.75	2		3	15	40			60
≤ 0.75 ≥ 0.50			2	4	18			24
< 0.50								
Total	*24*	*1*	*34*	*109*	*367*	*1*	*19*	*555*

Table 7.29. Rivoli Castelnuovo I. Lithotype distribution according to Bagolini's (1968) artefact categories (numerical quantities, complete pieces only).

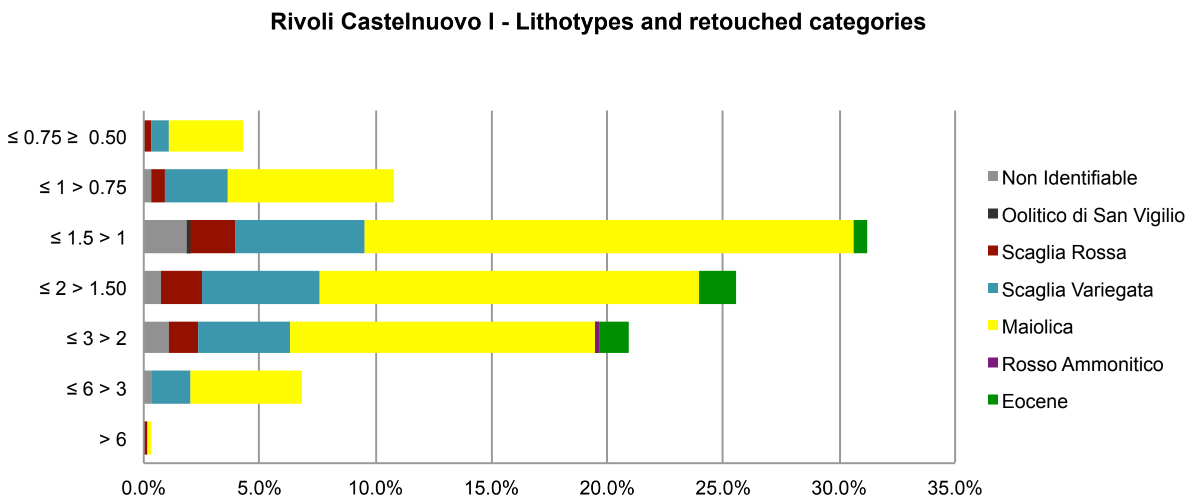


Fig. 7.24. Rivoli Castelnuovo I. Lithotype distribution according to Bagolini's (1968) artefact categories (numerical quantities, complete pieces only).

Debitage categories	Non Identifiable	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Total
> 6								
≤ 6 > 3	1			2	3			6
≤ 3 > 2	1		1	4	18			24
≤ 2 > 1.50	4		1	10	20			35
≤ 1.5 > 1				8	25		1	34
≤ 1 > 0.75	1			2	7			10
≤ 0.75 ≥ 0.50	1			1	1			3
< 0.50								
Total	*8*		*2*	*27*	*74*		*1*	*112*

Table 7.30. Rivoli Castelnuovo II. Lithotype distribution according to Bagolini's (1968) debitage categories (numerical quantities, complete pieces only)

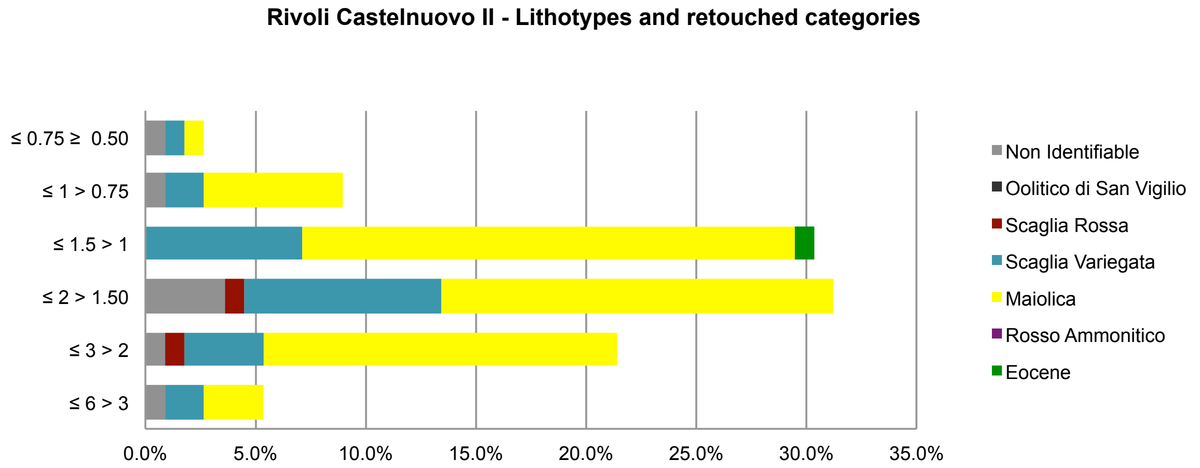


Fig. 7.25. Rivoli Castelnuovo II. Lithotype distribution according to Bagolini's (1968) artefact categories (numerical quantities, complete pieces only).

RCI Retouched Flakes Parent Material	Qty	%	Weight	%
Non identifiable	610	92.7%	3522.4	87.8%
Pebble glacio-fluvial Secondary Depositis	5	0.8%	56.2	1.4%
Pebble/nodule Secondary Deposits	25	3.8%	275.5	6.9%
Pebble/nodule Secondary Deposits TERRA ROSSA	12	1.8%	89.2	2.2%
Nodule Primary Outcrops				
Block Primary Outcrops	6	0.9%	67	1.7%
Total	*658*	*100.0%*	*4010.3*	*100.0%*

Table 7.31. Rivoli Castelnuovo I. Retouched flakes and parent material distribution.

RCII Retouched Flakes Parent Material	Qty	%	Weight	%
Non identifiable	151	92.1%	828.5	85.9%
Pebble glacio-fluvial Secondary Depositis				
Pebble/nodule Secondary Deposits	10	6.1%	103.8	10.8%
Pebble/nodule Secondary Deposits TERRA ROSSA	3	1.8%	32.7	3.4%
Nodule Primary Outcrops				
Block Primary Outcrops				
Total	*164*	*100.0%*	*965*	*100.0%*

Table 7.32. Rivoli Castelnuovo II. Retouched flakes and parent material distribution.

RCI Retouched Blades Parent Material	Qty	%	Weight	%
Non identifiable	231	92.4%	783.6	86.6%
Pebble glacio-fluvial Secondary Depositis				
Pebble/nodule Secondary Deposits	15	6.0%	94.7	10.5%
Pebble/nodule Secondary Deposits TERRA ROSSA	4	1.6%	26.9	3.0%
Nodule Primary Outcrops				
Block Primary Outcrops				
Total	*250*	*100.0%*	*905.2*	*100.0%*

Table 7.33. Rivoli Castelnuovo I. Retouched blades and parent material distribution.

RCII Retouched Blades Parent Material	Qty	%	Weight	%
Non identifiable	78	96.3%	286.3	95.3%
Pebble glacio-fluvial Secondary Depositis	1	1.2%	2	0.7%
Pebble/nodule Secondary Deposits	2	2.5%	12.1	4.0%
Pebble/nodule Secondary Deposits TERRA ROSSA				
Nodule Primary Outcrops				
Block Primary Outcrops				
Total	*81*	*100.0%*	*300.4*	*100.0%*

Table 7.34. Rivoli Castelnuovo II. Retouched blades and parent material distribution

Discussion of results

Analysis undertaken in this section has shed some light on raw material procurement for the Neolithic assemblage from Rocca di Rivoli. One of the research questions set out at the start of this work asked which raw materials flint knappers at Rocca di Rivoli made use of. Flint coming from the Maiolica rock formation was without doubt the preferred raw material to work with, followed, although at some distance, by that coming from the Scaglia Variegata formation. This pattern is common to all artefact classes with no exceptions (Table 7.35).

Raw material	Archaeological phases	Cores	Debitage		Retouched		Debris
			Flakes	Blades	Flakes	Blades	
Maiolica	RC I	58.02%	64.79%	67.00%	61.97%	65.87%	39.98%
	RC II	65.77%	58.94%	58.89%	69.65%	66.18%	28.33%
Scaglia Variegata	RC I	24.37%	18.41%	20.30%	22.78%	20.88%	14.10%
	RC II	19.04%	22.38%	14.64%	16.85%	25.33%	17.06%

Table. 7.35. Distribution of lithotypes from Maiolica and Scaglia Variegata rock formations across all artefacts classes (weight).

When looking closer at Table 7.35, one can see minor fluctuations between the earlier occupation phase (Rivoli Castelnuovo I) and the later one (Rivoli Castelnuovo II). A number of reasons might account for these. Firstly, the process of lithotype identification is affected by the overall condition of the artefacts. As already pointed out, the assemblage from Rivoli Castelnuovo II phase sees an increase in burnt or thermally altered artefacts, which causes the non-identified artefact class to rise considerably. Unfortunately thermal treatment prior to knapping was only tentatively recorded in the absence of microscopic analysis in a handful of cases. For the time being, thermal alteration is therefore pointing to flint coming close or falling into the fire. Again microscopic analysis might help in investigating the possible reasons for this increase which might relate to a change in practice either during the knapping itself or in the organization and disposal of the remains on the ground.

Other dynamics might be suggested for different choices in terms of the raw material utilized. It is interesting to note how certain lithotypes, although present in very small numbers during the Rivoli Castelnuovo I occupation phase, are totally absent for some classes of artefacts during the Rivoli Castelnuovo II period. For instance, no flint cores from Rosso Ammonitico or Eocene sources were recorded for the later phase. Similarly, no debitage or retouched artefacts belonging to the Rosso Ammonitico lithotype are present in the later occupation phase of Rivoli Castelnuovo II, whereas debitage of Oolitico di San Vigilio is represented by only a couple of flakes (but no blades). This data suggests a deliberate choice to not use this variety of raw material, or the impossibility of obtaining it. I argue here that it was more a deliberate decision not to use those lithotypes, rather than the impossibility of gaining access to the outcrops. Quality of flint coming from the Maiolica and Scaglia Variegata rock formations is far superior when compared to the rest of the raw material available (see Chapter 5). It seems that flint knappers working on the Rocca during the later phase of occupation preferred to use only the best raw material available. There might be other factors to take into consideration for this change and these might emerge when looking at the next step in the *chaîne opératoire*, i.e. initial flaking and core reduction. For the time being however, there does not seem to be valid reasons to argue for a change in raw material access. The Scaglia Rossa and Rosso Ammonitico flint types are both available from the naturally occurring detritus along the river bank. In addition, the nearest primary outcrops and secondary glacio-fluvial deposits for both flint types are located at about 1 to 6 km from the site. Yet neither flint varieties were sought after.

Why was flint from the Maiolica and Scaglia Variegata variety preferred to the rest of the flint types available? The main reason must be that their mechanical properties are far superior when compared to the rest of the flint varieties in the area. Some flint varieties from these lithotypes also resemble each other. For instance, their colour range tends to be very similar, especially the range of greys and browns. It is very likely that the identification of suitable raw material started with finding one of the right colour, be it grey (apparently the most sought after), brown or yellow. Colour identification, combined with knowledge of outcrop location in the landscape, were most probably guiding raw material selection.

The area surrounding Rocca di Rivoli is very rich in flint outcrops, but where was the raw material coming from? In Chapter 5 and briefly above I considered the problematic attribution of parent material type and how hypotheses based on this type of data need necessarily be taken with a good deal of caution. The data available at this stage, although retrieved from a very small part of the entire assemblage, points to a preference for secondary sources, such as deposits accumulated at valley bottoms, and in particular *terra rossa* deposits for flint coming from the Maiolica rock formation. Glacio-fluvial deposits and primary outcrops would appear less important for Rocca di Rivoli late Neolithic flint knappers. Secondary deposits are again very close to the site, from 3 to 8 km.

One possible reason accounting for this decision might relate to the quality of raw material.

Although pebbles and nodules collected from fluvial deposits during fieldwork are on average good for knapping, it was noticed that flint belonging to the Maiolica and Scaglia Variegata (i.e. the variety preferred by Rocca di Rivoli late Neolithic knappers) was not always available at these locations (see Chapter 5). Available literature also suggests that pebbles collected from glacio-fluvial deposits are likely to carry potential flaws, due primarily to their having rolled along with other stones in water or having dragged under pressure of glacial activity (ice fractures). Access, rather than raw material quality, might be a more likely reason for making primary outcrops less appealing to retrieve flint from. In some cases, some of the outcrops sampled during fieldwork required hard work: flint had to be extracted with digging/mining tools. This clearly required a set of skills and social organization that went well beyond picking up and testing a nodule from the ground. The presence of dark yellow/ochre flint coming from Scaglia Variegata outcrops cannot exclude a priori a provenance from primary outcrops at Passo del Piccon or on Mount Baldo. Not as labour intensive but still demanding, was the procurement of flint nodules (primarily Maiolica but also Scaglia Variegata) from *terra rossa* deposits. In this case, some digging is required to free the nodules from the red clayey deposit containing them. For both primary outcrops and *terra rossa* deposits, it is likely that some form of organization or at least coordination was required to carry out extraction. Similarly there are secondary deposits which are located further from the ones described above, between 10 and 30km away, and procurement from these sources would have also required coordinated efforts.

Coordination and organization were probably taking place on a regular basis at Rocca di Rivoli. It is unclear, however, from raw material analysis above, who was responsible for the procurement of the raw material, whether the same knappers flaking at the site were also procuring the raw material, and how the latter reached the site (e.g. via members of other communities living closer to the flint sources). To answer these questions, it is necessary to explore further the nature of flint knapping at Rocca di Rivoli. In particular to try to understand whether flint knapping was exclusive to specific people in the community, such as expert artisans and their apprentices, or if anyone could knap at their heart's content regardless of their ability (such as in when people weaving needed a scraper for shaping sheep bones into needles or those preparing dinner needed a few flakes to process meat). There is not much at this stage pointing unmistakably towards one or the other or combinations of both possibilities. There are, however cores coming from pits U and O that do raise a few questions in regards to how flint knapping and raw material procurement unfolded on the Rocca. Although formally classified as cores, there is no doubt that neither ID 4405 or ID 4439 could have produced usable debitage, not even in the hands of the most expert of the knappers. Both cores are of extremely poor raw material, with visible faults and fissures. They have incipient cones on the pseudo striking platform. It is unsure whether they were used, although they might have been used as hammers or to rejuvenate quern stones (Lunardi 2008: 45). This latter use would not have been responsible for the incipient cones, which resulted uniquely from having used a stone hammer on the cores (in the attempt to detach pieces of debitage). It is clear that whoever picked up those nodules, did not know how to asses flint quality. It is also clear that whoever started knapping them, did not understand the process. It is possible that these artefacts were used by young children (not even apprentices) imitating adults knapping or being taught part of the process of learning raw material suitability.

Putting aside these two peculiar finds, parent material analysis tells that, despite flint from the Maiolica and Scaglia Variegata rock formations being the best raw material available and thus preferred by knappers at Rivoli, other types of lithotypes were collected and brought all the way up the Rocca. These are pebbles of Scaglia Rossa readily available from the river bed and employed for the production of debitage, i.e. mostly flakes, which were probably used to carry out a number of tasks (such as food processing summarily described above) without the involvement of expert knappers.

Data available so far suggest three possible scenarios for raw material procurement at Rocca di Rivoli. The first, which can be referred as "embedded" probably took place on a daily basis. People engaged in other activities (e.g. water fetching from the river, goat herding, hunting) picked up potentially useful nodules or pebbles of flint as they go about their tasks. They test this as they pick it up and if it is good they carry it with them when returning to the settlement where it would be knapped to produce flakes for immediate use. This might have happened, for example, to those Scaglia Rossa pebbles identified as coming from glacio-fluvial deposits, as well as those coming from no better specified secondary deposits.

The second hypothesis is for expert knappers to set out to procure their own flint for the day's knapping. Secondary deposits located at a few hours walk usually provide exactly what they need without too much effort. However, they might decide to bring one or two apprentices with them and take this as a training trip to have the novices learn about the different types of flint and the different types of locations, venturing to either a *terra rossa* deposit or a primary outcrop for training purposes. These might turn into special trips also in the context of flint knapping initiation or other types of rites of passage as ethnological examples point at (Sillitoe & Harding 2003).

The third hypothesis sees the flint reaching the site as pre-cores or already prepared cores, probably brought by a member of another community who sets off on a one- or two-day trip as part of an exchange agreement. Rocca di Rivoli was at the centre of long-distance routes and a great deal of exchange was going on there, as allochthonous pottery hints at. There is no doubt that flint was one of the materials being exchanged and it is likely that nearby communities would have taken their flint up here to find a suitable exchange counterpart.

As analysis proceeds it will be possible to explore and test these concepts further. Importantly, there will be more elements to understand how knowledge acquisition was taking place. For the time being, cores ID 4405 or ID 4439, represent an anecdote rather than a fully developed narrative, perhaps that of a particular practice relating to the involvement of young kids in the procurement of flint or the making of a mistake during flint procurement. I believe prehistoric communities need to be re-thought in terms of specific practices and their historical peculiarities which might only reach us as isolated anecdotes rather than fully coherent narratives (Gossman 2003: 16).

Chapter 8

INITIAL FLAKING AND CORE REDUCTION

This section analyses attributes indicative of knappers' behaviour and choices during flint flaking. A first very broad differentiation is generally made between initial flaking, when raw material in the form of a nodule, pebble or block is tested for its suitability, and subsequent shaping to prepare the core. After core preparation, reduction can take place until the debitage platform or surface needs to be rejuvenated (core *remise-en-forme*).

The initial flaking and core preparation stages shape the raw material into a pre-determined core. The knapper's objective is to create a suitable striking platform and debitage surface in order to detach flakes, taking into consideration the specific volumetric characteristics of the raw material. Archaeologically, this stage is documented by the presence of tested raw material, pre-cores and fully corticated debitage with little or no preparation. Conceptually, test flaking and core preparation are two distinct steps, implying a different set of skills as well as objectives. However, in the absence of refits these two phases are impossible to distinguish with confidence when looking at the debitage products alone. One might set apart a tested nodule from a pre-core on the basis of the number of removals left on the artefact, as well as the degree of overall preparation detectable on a pre-core but still absent on a tested block or pebble. However, debitage pieces detached in the course of test flaking or core preparation are, matter-of-factly, identical.

In Chapter 4, it was arbitrarily decided to consider any flint rock with a maximum of three removals as a tested raw material piece and any flint block/pebble with a high percentage of cortex or natural surface (more than 75% of the total surface) and lack of well defined striking platform or debitage surface, as a pre-core.

Core reduction sees a number of sequential actions during which flaking continues until the striking platform or debitage surface or both need to be reshaped (rejuvenation), in order to continue to be used to produce artefacts. Core reduction ends when it becomes impossible to detach additional flakes, either because of the exhaustion of the core itself, irrecoverable mistakes, or the discovery of an unexpected flaw in the raw material. The key questions to be addressed here are concerned with the ways in which Neolithic knappers at Rocca di Rivoli went about flaking the procured raw material. Analysis will focus on:

1. The types of debitage knappers produced at Rocca di Rivoli and how these were obtained;
2. The types of hammer used;

3. Skill levels in preparing their striking platforms;
4. The social identity of knappers and the presence of learners;
5. The knapping mistakes made and the reasons for these.

Analysis, as in Chapters 6 and 7, will closely follow the guidelines set out in Chapter 4 and proceed to interrogate data related to cores and debitage. Occasionally analysis will focus on specific artefact types to further explore patterns at assemblage level.

Cores

Scars left on cores indicate the type of debitage that was removed from them at a specific time, which in the majority of samples from Rocca di Rivoli coincides with the end of the core flaking life. Table 8.1 provides an overall picture of the types of removals found on cores coming from the two different archaeological phases. Figures 8.1 and 8.2 show the percentage values of removal types within the two assemblages. When looking at the pie charts provided below, it is evident that overall, the majority of cores display flake removals. Mixed (blade-and-flake) removals represent a small percentage and blade cores (i.e. blades, bladelets, blades-and-bladelets) make up a very narrow percentage of the entire assemblage.

Cores Removal types	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total	
	Qty	Weight	Qty	Weight	Qty	Weight
Bladelets	5	109.3	1	7.6	6	116.9
Blades	4	150.6	2	106	6	256.6
Blades-and-bladelets	4	63.4	2	41.4	6	104.8
Flakes	127	4353.1	11	235.1	138	4588.2
Mixed	23	767.6	6	172	29	939.6
Total	*163*	*5444*	*22*	*562.1*	*185*	*6006.1*

Table 8.1. Removal types on cores coming from the two archaeological phases at Rocca di Rivoli.

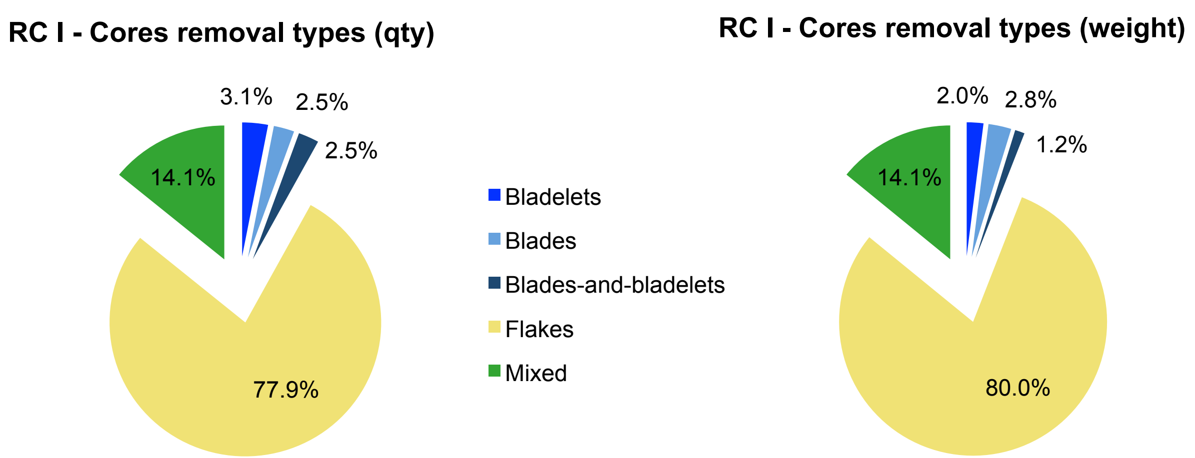


Fig. 8.1. Removal types on Rivoli Castelnuovo I cores (percentage values).

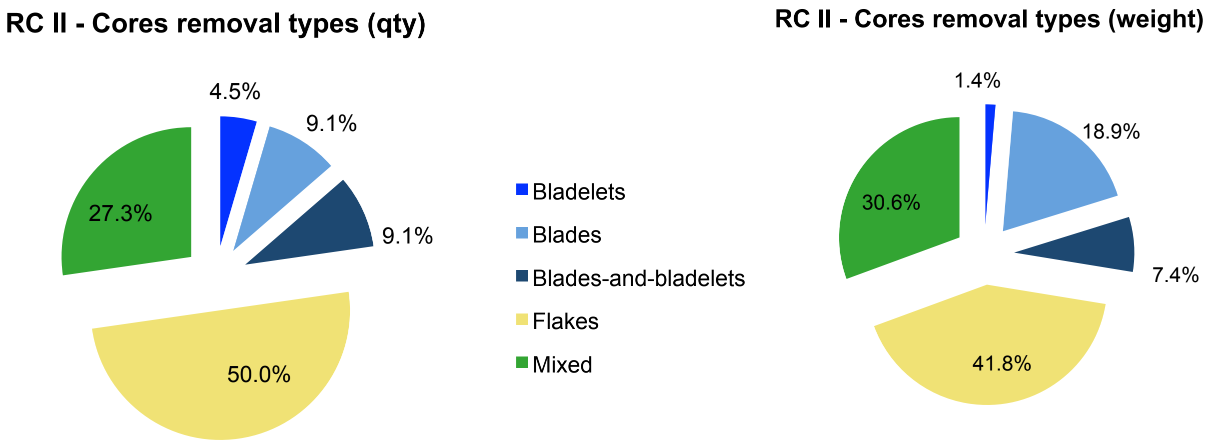


Fig. 8.2. Removal types on Rivoli Castelnuovo II cores (percentage values).

Although some caution is needed when comparing the two assemblages, in particular the smaller Rivoli Castelnuovo II assemblage, it is interesting to note how the incidence of flake cores diminishes in the later phase (from 77.9% to 50%) and cores presenting mixed and blade removals are proportionally higher in number (rising from 22.2% to 50%).

Cores on flakes (i.e. cores resulting from the removal of large flakes of raw material from a pre-existing flint nodule) make up roughly 29% of the Rivoli Castelnuovo I assemblage and approximately 27% of the Rivoli Castelnuovo II one. When comparing removal types on cores and cores on flakes (Tables 8.2 and 8.3) the two assemblages present a slightly different picture. The majority of both cores and cores on flakes from the Rivoli Castelnuovo I phase display flake removals (79.1% and 75% respectively), followed by mixed removals (16.5% and 8.3% respectively).

RC I Cores removal types	Cores		Cores on flakes		Total	
	Qty	%	Qty	%	Qty	%
Bladelets	2	1.7%	3	6.3%	5	3.1%
Blades	2	1.7%	2	4.2%	4	2.5%
Blades-and-bladelets	1	0.9%	3	6.3%	4	2.5%
Flakes	91	79.1%	36	75.0%	127	77.9%
Mixed	19	16.5%	4	8.3%	23	14.1%
Total	*115*	*100.0%*	*48*	*100.0%*	*163*	*100.0%*

Table 8.2. Removal types on cores and cores on flakes from Rivoli Castelnuovo I contexts (numerical quantitites only).

RC II Cores removal types	Cores		Cores on flakes		Total	
	Qty	%	Qty	%	Qty	%
Bladelets	1	6.3%			1	4.5%
Blades	2	12.5%			2	9.1%
Blades-and-bladelets	1	6.3%	1	16.7%	2	9.1%
Flakes	9	56.3%	2	33.3%	11	50.0%
Mixed	3	18.8%	3	50.0%	6	27.3%
Total	*16*	*100.0%*	*6*	*100.0%*	*22*	*100.0%*

Table 8.3. Removal types on cores and cores on flakes from Rivoli Castelnuovo II contexts (numerical quantities only).

When looking at blade removals, it can be seen how cores on flakes represent proportionally a higher incidence. The majority of cores on flakes coming from Rivoli Castelnuovo II deposits display mixed removals. Only one of them shows a mix of blade and bladelet removals. Again caution is required here since Rivoli Castelnuovo II percentage values are based on a very small number of artefacts.

Blade Cores

Cores displaying blade (including bladelet and bladelet-and-blade) removals mainly belong to Maiolica and Scaglia Variegata lithotypes, with two exceptions for the Rivoli Castelnuovo I phase: ID 4320 and ID 946. The first is a unidirectional bladelet-and-blade core coming from the Eocene rock formation. The second is a poor attempt to flake narrow blades from a small block of Scaglia Rossa flint. Despite the fact that this latter core can be classified, in terms of attributes, as a bladelet core, only two bladelets were removed. As regards the Rivoli Castelnuovo II phase only cores belonging to the Scaglia Variegata and Maiolica lithotypes were found to display blade removals on their debitage surfaces (Tables 8.4 and 8.5).

RCI Cores Removal types	Not identifiable		Scaglia Rossa		Scaglia Variegata		Maiolica		Rosso Ammonitico		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Bladelets			1	0.6%	1	0.6%	3	1.8%					5	3.1%
Blades					1	0.6%	3	1.8%					4	2.5%
Blades & Bladelets					3	1.8%					1	0.6%	4	2.5%
Flakes	7	4.3%	11	6.7%	32	19.6%	74	45.4%	2	1.2%	1	0.6%	127	77.9%
Mixed	2	1.2%			2	1.2%	18	11.0%			1	0.6%	23	14.1%
Total	*9*	*5.5%*	*12*	*7.4%*	*39*	*23.9%*	*98*	60.1%	*2*	1.2%	*3*	1.8%	*163*	100.0%

Table 8.4. Rivoli Castelnuovo I core removals according to lithotypes (numerical quantities).

RCII Cores Removal types	Not identifiable		Scaglia Rossa		Scaglia Variegata		Maiolica		Rosso Ammonitico		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Bladelets							1	4.5%					1	4.5%
Blades					1	4.5%	1	4.5%					2	9.1%
Blades & Bladelets							2	9.1%					2	9.1%
Flakes	2	9.1%	1	4.5%	2	9.1%	6	27.3%					11	50.0%
Mixed	2	9.1%					4	18.2%					6	27.3%
Total	*4*	*18.2%*	*1*	*4.5%*	*3*	*13.6%*	*14*	*63.6%*					*22*	*100.0%*

Table 8.5. Rivoli Castelnuovo II core removals according to lithotypes (numerical quantities).

The sample of cores displaying blade removals is very limited: only 18 pieces (13 from Rivoli Castelnuovo I and 5 from Rivoli Castelnuovo II archaeological phases respectively) out of 185, i.e. approximately 9.73% of the total core assemblage. The majority of blade cores (including bladelet and blade-and-bladelet) display corticated portions that represent between 5% and less than 50% of the total artefact surface.

All of the blade cores coming from both archaeological phases, with the exception of a Maiolica core (ID 4328 belonging to Rivoli Castelnuovo I phase), display a unidirectional knapping mode. After the creation of a suitable striking platform, blades and bladelets are always flaked off from the one platform. This knapping mode gives rise to the so-called “pyramid” shape, or, perhaps more appropriately in the specific case of Rocca di Rivoli, a “pseudo-pyramid” shape for cores and “half-pyramid” for cores on flakes, since for the latter, the detachment of blades applies to only one side of the core. The remaining 1/3 of the core is for the majority left corticated or natural: 12 cores out of 18 have cortex on either debitage surface and/or core base, whereas 2 have cortex on the striking platform.

In addition to ID 4328 (RC I) two cores do not resemble the pseudo-pyramidal shape: ID 946 (RC I) and ID 4465 (RC II). The first is a small Scaglia Rossa small block, already described above, with only two knapping attempts: nothing more will be said about this core which was probably abandoned immediately after the poor flaking attempt. The second is a honey-coloured Maiolica core, displaying 3 blade removals limited to one edge of the core. Blades were removed directly from the corticated platform following rough abrasion.

ID 4328 displays two orthogonally opposed platforms. Blades were struck by means of a punch from both platforms following an alternating rhythm. Both platforms were accurately prepared through the removal of tiny portions of platform projecting outwards (the so called “overhang”), followed by light abrasion. Convexity of the debitage surface was maintained through the removal of flakes from the right and left sides, and by further removal of trimming flakes on both striking platforms.

Platform preparation is a feature exclusive to 6 out of 13 blade cores (including bladelet and blade-and-bladelet cores) coming from Rivoli Castelnuovo I deposits. Preparation consists of the overhang removal and subsequent abrasion (e.g. ID 4395, 4320 and, although less systematically, ID 4396). The remaining blade cores do not display overhanging portions of their striking platforms still in place, and only on three occasions these were contrasted by approximate abrasion. Of the blade cores from Rivoli Castelnuovo II deposits, only ID 4465 displays some abrasion of the corticated cornice; the rest do not have any trace of platform preparation. This type of data will be compared to that coming from attributes recorded on blades, such as platform preparation showing on blade butts (see below).

On the basis of the degree of platform preparation and on the type of scars left on cores, it was possible to recognise four types of knapping modes (Table 8.6). The first is indirect or pressure flaking by means of a punch, associated with careful platform preparation (both overhang removal and subsequent abrasion), and with regular scars characterised by the presence of small bulb of percussion negatives and faint ripples. This technique is at times associated with thermal treatment of the core prior to knapping.

The second technique is represented by direct flaking with a hammerstone (soft or hard) on an anvil, which sees little or no preparation of the striking platform and scars characterised by a more or less marked negative bulb of percussion depending on the type of hammer used (a marked bulb of percussion is associated with a hard hammer). The base of the core bears traces of chipping or tiny scars with ripples going in the opposite direction to the main knapping trajectory. ID 4551 (RC I) can be taken as example here. This core has a worn lower part resulting form edge abrasion through use or from the technique used by the knapper for removing the bladelets. The latter was probably a variation of the anvil technique for which, due to its small dimensions, the flint piece is held in place during flaking by being positioned on a surface and held still. When the surface on which the core is positioned is a hard one, the pressure generated by each blow, in addition to detaching the desired blade, removes little flakes from the lower part. When striking platform and lower end are orthogonal to each other, the debitage product resulting from knapping might be a *piéce esquilleé* or splintered piece, with its dorsal surface displaying tiny removals on the distal end that go in the opposite direction to the main ripples left by the previous removal(s). In this specific example, the platform and lower end are not orthogonal, so that bladelets could be detached, probably with the help of a soft hammer.

Knapping Techniques	**RCI**			**RCII**			**Total**
	Bladelets	**Blades**	**Bladelets-and-blades**	**Bladelets**	**Blades**	**Bladelets-and-blades**	
Not identifiable	1	1				1	3
Indirect/Pressure	2	1	2	1	1		7
Direct (hard hammer)		2			1		3
Direct (soft hammer)	2		1				2
Anvil	1 (SF)		1 (I/P)			1 (I/P)	3
Total	*5*	*4*	*4*	*1*	*2*	*2*	*18*

Table 8.6. Knapping techniques resulting from blade cores from Rocca di Rivoli (numerical quantities). SF=soft hammer, I/P=indirect/pressure.

A third knapping technique is a variation of the second, in which the core is still placed on an anvil but flaked with a punch through indirect percussion or pressure. Important differences from the previous technique are the types of scars left on the core: these resemble the characteristic pressure flake scars (see above) often associated with careful preparation of the striking platform. Distal chipping resulting from the probable use of a stone anvil are recognisable on ID 4396 (RC I) and ID 4450 (RC II).

Finally, the fourth and last technique is direct percussion by means of a hard hammer, which sees little or no preparation of the striking platform and scars characterised by marked negative bulbs of percussion. Soft hammers might also be employed in the latter technique, and might be recognised by the presence of diffuse or flattened-out negative bulbs of percussion on the debitage surface.

Thermal modification is apparent on 5 cores. However, two of them (ID 4293 and 4550, RC I) differ considerably from the rest which bear traces of burning. Both cores display traces of heating on their striking platform and debitage surface which might be associated with the use of thermal treatment in association with the production of blades by means of indirect percussion (punch). At the same time, it should be noted that such features can be displayed also by flint accidentally left near a heat source but not directly in contact with it, and that recognition of the technique is still highly debated and affected by the analyst's perception.

To gain an approximate idea of the nature of exploitation of the raw material in relation to the production of debitage, it is useful to compare dimensions of the last scars left on cores. The longest scar recorded on a blade core from Rivoli Castelnuovo I is 35mm (12mm wide) whereas the shortest (not including step fractures) is 14mm (4mm wide). With the exception of ID 4465 (RC II), from which, arguably, more blades or bladelets could have been removed, the longest blade scar on a for Rivoli Castelnuovo II core measures 29mm (9mm wide) whereas the shortest (not including step fractures) is 20mm long (6mm wide).

In general, it can be observed that blade cores have entered the archaeological record at the end of their knapping biography (with the exception of ID 4465). Cortex removal and last scar dimensions show that the raw material was exploited thoroughly. Knappers needed an irretrievable mistake to give up taking out more blades or bladelets from these cores. Preparation varied highly. A few cores display features which reflect a considerable amount of time investment, requiring high levels of accuracy and precision. However, the majority of them do not and are characterised by only rough platform preparation and irregularly shaped blade scars. This is especially true for the Rivoli Castelnuovo II cores. At the same time, one has to bear in mind that only the final stage of core exploitation is being observed and that it probably made sense not to remove the platform overhang when no further blades were to be flaked off (as in the case of the possibly thermally treated core ID 4293, RC I).

Unfortunately, little information could be retrieved with regard to opening strategies. Only one core was discarded at the initial stage of preparation (ID 4465, RC II). In this case, the shape of the pebble was exploited and the natural angle provided by two of its surfaces was used to remove the first corticated blades. No platform preparation is noticeable, although this might have taken place at a later stage when part of the core would have been freed from cortex. Nonetheless, blades were detached with roughly parallel edges and a straight profile. The overall feeling when looking at ID 4465 (RC II) is that it probably represents the initial stage of a core type resembling ID 4328 (RC I). However, this is only a guess since the stages in between are hard to identify at debitage level. Further exploration into the other debitage categories is needed to integrate the yet partial picture provided by blade cores.

Mixed cores

There are in total 29 cores and cores on flakes that have blade and flake scars, comprising approximately 15.68% of the total core assemblage. Of these, 23 (19 cores and 4 cores on flakes) come from Rivoli Castelnuovo I deposits and 6 (3 cores and 3 cores on flakes) belong to the Rivoli Castelnuovo II phase. The majority of mixed cores belongs to the Maiolica lithotype, only two from Rivoli Castelnuovo I contexts coming from other rock formations: IDs 4267 (Eocene) and 4457 (Scaglia Variegata). For 4 cores (two from Rivoli Castelnuovo I and two from Rivoli Castelnuovo II) it was not possible to attribute a raw material type because of thermal alteration preventing identification of lithotype characteristics. Table 8.7 displays the amount of cortex left on mixed cores. Again, most of them entered the archaeological record with little or no cortex left on them.

Amount of cortex on mixed cores	Rivoli Castelnuovo I	Rivoli Castelnuovo II	Total
absent	7	6	13
≤ 5%	2		2
>5% ≤ 25%	11		11
>25% ≤ 50%	3		3
>50% ≤ 75%			
>75%			
Total	*23*	*6*	*29*

Table 8.7. Amount of cortex present on mixed cores from Rocca di Rivoli (numerical quantities).

Debitage direction recorded on mixed cores with 1, 2 and 3 striking platforms is summarized in Table 8.8. Knapping modes differ partly in relation to the number of platforms. One-platform cores (11 from Rivoli Castelnuovo I, and 1 from Rivoli Castelnuovo II contexts) show an exclusively unidirectional knapping mode.

Knapping direction on mixed cores	Rivoli Castelnuovo I			Rivoli Castelnuovo II			Total
	1 platform	2 platforms	3 platforms	1 platform	2 platforms	3 platforms	
One direction	11			1			12
Multidirectional		1	4		1	1	7
Bipolar							
Simple and side		4			2		6
Simple and opposed		3			1		4
Total	*11*	*8*	*4*	*1*	*4*	*1*	*29*

Table 8.8. Debitage direction on mixed cores coming from Rocca di Rivoli (numerical quantities).

Cores and cores on flakes marked by a unidirectional flaking mode and one platform are very similar in shape to blade and bladelet cores. The example closest to a pyramid-shaped core of the whole mixed core assemblage is ID 4267 (RC I). The knapper tried to remove blades and flakes from all around the debitage surface. The first step was the removal of the natural patinated surface in order to obtain a suitable debitage surface with the right convexity. Subsequently, a striking platform was prepared in order to detach flakes and blades using a hard hammer. Platform preparation was undertaken by abrasion. The knapper was not successful in detaching all the blades he/she intended to from this core. After the initial removal of a few flakes, attempts to remove blades failed, generating step fractures all along the edge of the striking platform. Only the scar of one twisted blade is still visible. The knapper probably rested the core on a hard surface whilst flaking off debitage pieces, since the base of the core has the typical chipping and microfractures associated with the anvil technique.

Another core that resembles a pyramid in shape is ID 4545 (RC I). The knapper here used a similar knapping strategy: the right convexity was maintained through the removal of flakes from the base of the core as scars 4 and 5 show. In this case, one of the objectives was probably that of removing the surviving cortex. This latter goal was, however, not achieved. Blades, bladelets and flakes were subsequently removed from a platform which underwent careful preparation, i.e. the overhang was removed and the edge was abraded, leaving a smoothed-out appearance. It is possible that a soft hammer was employed for detaching debitage from this core.

In the case of ID 4322 (RC I), a core on a chunky flake removed from a bigger core, a striking platform was created through the removal of a single flake. Little preparation went into obtaining a suitable platform from which to remove blades or flakes. After the removal of the first flake, a series of step fractures made it impossible to continue knapping since both striking platform and debitage surface became heavily compromised.

Mixed cores with two platforms present three types of knapping modes:

- Simple and side: 4 out of 8 for Rivoli Castelnuovo I (e.g. IDs 4459 and 4494); and 2 out of 4 for Rivoli Castelnuovo II.
- Simple and opposed: 3 out of 8 for Rivoli Castelnuovo I (e.g. IDs 4261); and 1 out of 4 for Rivoli Castelnuovo II (ID 4420).
- Multidirectional: one from Rivoli Castelnuovo I; and one from Rivoli Castelnuovo II.

Simple-and-side mixed cores exploit a first platform from which one or more flakes and/or blades are detached. Subsequently, the core is rotated approximately 90° and part of what was the debitage surface in the previous stage is used as a striking platform to knap some more flakes. For both IDs 4459 and 4494 (Rivoli Castelnuovo II) it is likely that the removal of flakes and blades after 90° rotation was prompted by mistakes affecting the debitage surface (step fracture and repeated step fractures). The angle for the second platform is created by knapping into the debitage surface in order to create a new striking platform nearly perpendicular to the first one. The side of the core often accommodates this second platform, which comes to occupy the area from where flakes had previously been removed to ensure striking platform rejuvenation (i.e. *remise-en-forme* for maintaining a suitable angle).

Simple and opposed cores exploit a first platform from which one or more debitage pieces are removed. Subsequently the core is rotated roughly 180° and blades/flakes are knapped off what was previously the base of the core (e.g. IDs 4261, 4378, 4387 (RC I); and 4420 (RC II). Attempts on IDs 4378 and 4261 to detach debitage from the newly created platform were unsuccessful due to a step fracture which the knapper tried to recuperate by removing too much of both striking platform and debitage surface respectively. As for ID 4387, a fault in the raw material caused part of the core to shatter in an attempt to rejuvenate the newly-found striking platform.

A multidirectional knapping mode is characterised by more than two rotations of the core. There are only two examples of two-platform cores, but when one looks at three-platform mixed cores, the quantity of mixed cores displaying a multidirectional knapping mode rises to 5 (e.g. IDs 4374 and 4457, RC I; and ID 4280, RC II). Flakes or blades are detached from all three platforms, with the rhythm changing on the basis of the newly created angle and knapping surface resulting from the direction of previous removals. Change of direction, or the need for further core rotation, was probably dictated by a step fracture in the case of ID 4286 (RC I) and by the crushing of the striking platform on ID 4280 (RC II). This knapping mode seems to concentrate on optimizing the number of flakes or blade(let)s potentially extractable from the final stage of core reduction.

Only three cores from Rivoli Castelnuovo I contexts show some degree of platform preparation (IDs 4387, 4459, 4545), by means of overhang removal and subsequent abrasion. It is likely that blades and flakes were detached by means of a soft hammer on IDs 4387 and 4459. In the case of ID 4545, it is probable that a punch was used instead. The rest of the cores show clear traces of hard hammer percussion: i.e. there is none or very little platform preparation through abrasion, while marked negative bulbs of percussion often with still visible eraillure scar negatives and well-defined ripples. None of the cores from Rivoli Castelnuovo II contexts had evidence for platform preparation other than casual abrasion of the cornice.

Five cores from Rivoli Castelnuovo I contexts (e.g. IDs 4570 and 4267) and two from Rivoli Castelnuovo II contexts (IDs 4280 and 4277) display a chipped core base, usually associated with the use of the anvil technique.

Similarly to blade cores, mixed ones also have an “exhausted” appearance about them: 24 out of 29 have entered the archaeological record thoroughly exploited, while only five might have provided, arguably, an additional one or two debitage pieces. Corticated surfaces of up to 25% were present on 26 out of 29 cores, indicative of the fact that the most of the core surface was turned into debitage surface. Also, with an exhausted or nearly exhausted core, it was more difficult to obtain blades, i.e. to maintain the conditions necessary to produce debitage with a length/width ratio higher than 2. Only 7 out of 29 mixed cores display blades as the last negatives to be removed, which does not come as a surprise if one thinks of step fractures, repeated step fractures and crushed platforms as the most common mistakes occurring on these types of cores.

In general, the majority of mixed cores display very different shapes reflecting high variability in the knapping strategies adopted as well as the shape of the raw material utilized. The general picture offered by mixed cores is one where knappers exploited the natural shape of the raw material in their hands, skirting around flaws in the flint, leaving out corticated zones impossible to negotiate while attempting to overcome previous mistakes (e.g. ID 4459, RC I). Mistakes are very common and contribute, along with the tiny dimensions of the exhausted cores to their final abandonment. The degree of precision which went into preparing the cores nearing the end of their core biographies is comparatively much less than that recognised on blade cores: only roughly 1/10 of mixed cores (compared to 1/3 of blade cores) saw some platform preparation in the form of overhang removal and careful abrasion of the cornice. Although the anvil technique was used for a few cores, only ID 4545 (RC I) shows features associated with indirect pressure. For the rest, a pronounced bulb scar and marked ripples do not leave any doubt that the hammer used was a hard one, though a soft hammer might have been used to flake IDs 4387 and 4459 (RC I).

Flake cores

138 cores present flake scars, approximately 75% of the total core assemblage. Of these, 127 of which (36 are cores on flakes) come from Rivoli Castelnuovo I deposits, and 11 (of which 2 are cores on flakes) come from Rivoli Castelnuovo II contexts. Table 8.9 shows raw material distribution for this category. Again, cores belonging to the Maiolica lithotype are the most numerous, followed by those coming from the Scaglia Variegata rock formation. Just over 10% (16 cores in total) represent other lithotypes (Scaglia Rossa, Rosso Ammonitico and Eocene), whereas 6.52% could not be identified. All of the latter were burnt.

Archaeological phases	Not identifiable		Scaglia Rossa		Scaglia Variegata		Maiolica		Rosso Ammonitico		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
RC I	7	5.1%	11	8.0%	32	23.2%	74	53.6%	2	1.4%	1	0.7%	127	92.0%
RC II	2	1.4%	1	0.7%	2	1.4%	6	4.3%					11	8.0%
Total	*9*	*6.5%*	*12*	*8.7%*	*34*	*24.6%*	*80*	*58.0%*	*2*	*1.4%*	*1*	*0.7%*	*138*	*100.0%*

Table 8.9. Raw material distribution for flake cores from Rocca di Rivoli.

When looking at the portion of cortex still surviving on flake cores (Table 8.10) only just over 11% of them presents cortex covering more than 25%: the majority from both phases (52.2%) display cortex between more than 5% and less than 25% whereas 30.4% of the entire flake core assemblage do not present any cortex.

Amount of cortex on flake cores	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total	
	Qty	%	Qty	%	Qty	%
absent	38	27.5%	4	2.9%	42	30.4%
≤ 5%	7	5.1%	1	0.7%	8	5.8%
>5% ≤ 25%	66	47.8%	6	4.3%	72	52.2%
>25% ≤ 50%	12	8.7%			12	8.7%
>50% ≤ 75%	4	2.9%			4	2.9%
>75%						
Total	*127*	*92.0%*	*11*	*8.0%*	*138*	*100.0%*

Table 8.10. Amount of cortex surviving on flake cores from Rocca di Rivoli.

Flake cores have 1, 2, 3 or 4 platforms (Table 8.11). One-platform flake cores display a unidirectional knapping mode, in which flakes are removed using a hard hammer. Striking platforms appear not to have received any preparation, with the exclusion of a few cores which display abrasion of the edge. However, such abrasion might also be caused by subsequent use. In a few instances, flakes are detached directly from the corticated platform, taking advantage of the natural shape of the raw material (e.g. ID 4265, RC I). Cores obtained from large flakes represent 46.9% of the one-platform core assemblage coming from Rivoli Castelnuovo I contexts (5 from the Scaglia Rossa formations, 5 belonging to Scaglia Variegata, and 13 from Maiolica rock formation), whereas there is none from the Rivoli Castelnuovo II contexts. Only a few one-platform flake cores (4%) from the Rivoli Castelnuovo I phase show cortex occupying up to 75% of the entire core surface (Fig. 6.52), indicating both their degree of exploitation and how removing cortex remained a knapping objective.

Flake core lithotype	RC I				RC II				Total
	1 Plt.	2 Plts.	3 Plts.	4 Plts.	1 Plt.	2 Plts.	3 Plts.	4 Plts.	
Non identifiable	4	3			1			1	9
Scaglia Rossa	6	4	1			1			12
Scaglia Variegata	10	17	4	1			2		34
Maiolica	27	31	12	4	2	4			80
Rosso Ammonitico	1		1						2
Eocene	1								1
Total	*49*	*55*	*18*	*5*	*3*	*5*	*2*	*1*	*138*

Table 8.11. Flake cores: distribution of lithotypes in relation to the number of platforms (numerical quantities).

Table 8.12 shows cortex percentage in relation to raw material for Rivoli Castelnuovo I one-platform cores. Although the disparity in numerical quantities between cores belonging to the Maiolica lithotype and the rest tends to hinder comparisons, it is interesting to note how cortex is absent from 18% of cores belonging to the Maiolica lithotype, 10% of Scaglia Variegata cores and 17% of Scaglia Rossa cores.

Lithotype	absent	%	≤ 5%	%	>5% ≤ 25%	%	>25% ≤ 50%	%	>50% ≤ 75%	%	Total	%
Non identifiable	1	2.0%			3	6.1%					4	8.2%
Scaglia Rossa	1	2.0%	1	2.0%			3	6.1%	1	2.0%	6	12.2%
Scaglia Variegata	1	2.0%			8	16.3%	1	2.0%			10	20.4%
Maiolica	6	12.2%			14	28.6%	6	12.2%	1	2.0%	27	55.1%
Rosso Ammonitico					1	2.0%					1	2.0%
Eocene					1	2.0%					1	2.0%
Total	*9*	*18.4%*	*1*	*2.0%*	*27*	*55.1%*	*10*	*20.4%*	*2*	*4.1%*	*49*	*100.0%*

Table 8.12. Rivoli Castelnuovo I one-platform flake cores. Distribution of cortex in relation to raw material type.

The smallest removal left on Rivoli Castelnuovo I one-platform flake cores measures 7x5mm, whereas the largest is 34mm long and 24mm wide. The length/width ratio of small flakes ranges from 0.5 to 1.8, only few millimetres from being classified as blades. There are only three one-platform flake cores of 11 from Rivoli Castelnuovo II contexts, the smallest removal measuring 13x10mm, and the largest 15x16mm.

Whereas most one-platform were discarded at an exhausted stage of exploitation, the one-platform Scaglia Variegata core ID 4455 (the largest of all cores, weighting 352.4g, from Rivoli

Castelnuovo I deposits), was left at a reduction-under-way stage. This single example may allow us to partially reconstruct an initial stage in the reduction sequence for one-platform cores. The striking platform was obtained through the removal of one big flake. Subsequently, it was abraded and flakes were detached with a hard hammer in order to remove the remaining cortex and create a suitable debitage surface freed of cortex. The right convexity of the debitage surface was provided by the removal of a corticated flake from the core base. Probably this core was then held on the hard surface whilst another flake was detached from the striking platform. The blow of the hard hammer on the striking platform travelled along the debitage surface removing the flake but detaching also tiny chips from the previously knapped core base resting on a hard surface. This core was probably put aside to be picked up at a later stage since no apparent reasons are detectable for the decision to discard it.

Two-platform flake cores, 60 in total (43.4% of the entire flake core assemblage) display four different types of debitage removals: multidirectional, simple-and-side, simple-and-opposed and divergent (Table 8.13). Only 5 cores from Rivoli Castelnuovo II belong to this group. The remaining 55 cores were unearthed from Rivoli Castelnuovo I pit deposits.

Lithotype 2-platform flake cores	Rivoli Castelnuovo I								Rivoli Castelnuovo II				Total	%
	multi-directional	%	simple-and-side	%	simple-and-opposed	%	divergent	%	multi-directional	%	simple-and-side	%		
Non identifiable	2	3.3%	1	1.7%									3	5.0%
Scaglia Rossa			4	6.7%					1	1.7%			5	8.3%
Scaglia Variegata	5	8.3%	8	13.3%	4	6.7%					4	6.7%	21	35.0%
Maiolica	8	13.3%	17	28.3%	5	8.3%	1	1.7%					31	51.7%
Total	*15*	*25.0%*	*30*	*50.0%*	*9*	*15.0%*	*1*	*1.7%*	*1*	*1.7%*	*4*	*6.7%*	*60*	*100.0%*

Table 8.13. Two-platform flake core knapping modes in relation to raw material.

Multidirectional scars indicate that the cores had been rotated several times and in different ways in order to exploit the two platforms. Scars from previous removals are intersected by more recent ones (e.g. IDs 4405 and 4397, RC I), showing how the knapper exploited the changing convexity and shape of the artefact to obtain additional flakes. Two-platform cores with a multidirectional knapping mode mostly belong to the Maiolica and Scaglia Variegata lithotypes. The only one core belonging to the Scaglia Rossa formation comes from a Rivoli Castelnuovo II context. Striking platforms appear not to have received any preparation, with the exception of a few cores which display some abrasion of the edge.

Simple-and-side two-platform flake cores exploit a first platform from which one or more flakes are detached. Subsequently, the core is rotated approximately 90° and the previous debitage surface is used as striking platform to knap some more flakes. The rhythm, i.e. the sequence of the rotating actions, varies between alternating (one removal from first platform, rotation, one removal from second platform, rotation back to first platform and so forth) or random (more than one removal from first platform followed by rotation when the angle or surface is no longer suitable for detaching more flakes and so forth). For both IDs 4311 and 4473 (RC I) it is likely that the removal of flakes after 90° rotation was prompted by mistakes affecting the debitage surface (step fracture and repeated step fractures). At times, the angle for the second platform is created by knapping into the debitage surface in order to create a new striking platform nearly perpendicular to the first one, though, there are instances in which the natural or modified shape of the core (accidental breakage, faults in raw material) provides a new, second platform, from which to detach flakes. Cores displaying a simple-and-side knapping mode are the most numerous (Table 8.13). The majority of them, predictably, belongs to the Maiolica (56.6%) and the Scaglia Variegata (26.6%) flint types. As with two-platform multidirectional cores, also simple-and-side cores appear not to have received any preparation, except for an isolated example (ID 4542) which displays systematic abrasion of the knapping edge.

Simple-and-opposed two-platform flake cores are rare and belong exclusively to the Maiolica and Scaglia Variegata lithotypes (Table 8.13). The two platforms are roughly orthogonal, located at opposite ends of the core. Flakes are removed by means of a hard hammer, generally with no preparation of the striking platform, although some abrasion is present. Removals can be detected on the same debitage face (e.g. ID 4464), or on different sides of the same debitage surface (e.g. IDs 4392 and 4447). In the former instance scars of previous removals are present on the dorsal face of debitage products, while in the latter flakes indicate only unidirectional removals since they were all detached from the same platform in different areas of the debitage surface. Four simple-and-opposed two-platform cores from Rivoli Castelnuovo I pit deposits (e.g. ID 4440) were probably knapped employing an anvil technique, as tiny chippings occurred to varying degrees on both platforms.

There is only one example (ID 4464, RC I) of a divergent knapping mode among two-platform flake cores. This core has two platforms roughly opposed. The first one was compromised by an irretrievable step mistake which undermined the striking platform integrity. At this point the core was rotated approximately 180° and the bottom of the core was prepared to flake off debitage. Flaking took place in a pseudo-alternating mode creating two debitage surfaces.

Cortex is not present at all on 33.4% of two-platform cores, but the majority (60%) have cortex covering between 5 and 25% of the core surface. Only a few show higher cortex cover (Table 8.14). The smallest removal left on two-platform cores from Rivoli Castelnuovo I contexts measures 7x10mm, whereas the biggest is 39mm long and 23mm wide (except for the outlier ID 4455). The length/width ratio ranges from 0.7 to 1.7. The largest removal from the tiny Rivoli Castelnuovo II group, measures 16x13mm, whereas the smallest is 9x8mm. The majority of length/width ratios for both groups show that mostly small flakes were removed from two-platform cores towards the end of their lives.

There are 26 three- and four-platform flake cores in total: 23 from Rivoli Castelnuovo I pit deposits (representing 16.6% of the total flake core assemblage) and 3 from Rivoli Castelnuovo II pits (representing 2.1% of the total flake core assemblage). Of the Rivoli Castelnuovo I cores, the majority belong to the Maiolica (69.5%) and Scaglia Variegata (21.7%) lithotypes. Only one core belongs to the Scaglia Rossa flint type and one comes from Rosso Ammonitico rock outcrops. As for Rivoli Castelnuovo II, two cores belong to the Scaglia Variegata lithotype and one is unidentifiable.

Lithotype 2-platform flake cores	Rivoli Castelnuovo I										Rivoli Castelnuovo II				Total	%
	absent		≤ 5%	%	>5% ≤ 25%	%	>25% ≤ 50%	%	>50% ≤ 75%	%	absent	%	>5% ≤ 25%	%		
Non identifiable	1	1.7%			2	3.3%									3	5.0%
Scaglia Rossa	2	3.3%			2	3.3%							1	1.7%	5	8.3%
Scaglia Variegata	3	5.0%	2	3.3%	10	16.7%			2	3.3%	1	1.7%	3	5.0%	21	35.0%
Maiolica	13	21.7%	1	1.7%	15	25.0%	2	3.3%							31	51.7%
Total	*19*	*31.7%*	*3*	*5.0%*	*29*	*48.3%*	*2*	*3.3%*	*2*	*3.3%*	*1*	*1.7%*	*4*	*6.7%*	*60*	*100.0%*

Table 8.14. Two-platform flake cores cortex distribution in relation to raw material type.

Debitage removals are exclusively multidirectional: the knapper exploited different platforms through multiple rotations of the core. When looking at the sequence of scars it is difficult to identify a rhythm or a consistent pattern for the removals. These cores end up taking a globular form (e.g. IDs 4295 and 4325, RC I) on which scars from previous removals are intersected by more recent ones (e.g. ID 4425, RC I), showing how the knapper exploited the changing convexity and shape of the artefact to obtain additional flakes.

Striking platforms appear not to have received any preparation, with the exception of abrasion of the edge, which might however be due to their subsequent utilization. Knapping was mostly carried out with a hard hammer, although three cores from Rivoli Castelnuovo I bear scars which were probably removed using a soft hammer. Most three- and four-platform cores (84%) are exhausted: it would not have been possible to detach another flake from them. Heavy exploitation is also reflected by their weight: 14 cores out of 26 (2 from Rivoli Castelnuovo II contexts) weigh less than 30g. The heaviest of the Rivoli Castelnuovo I cores weighs 74g, while the heaviest Rivoli Castelnuovo II core weighs 40.7g.

Cortex is absent on 43.4% (10 out of 23) of Rivoli Castelnuovo I 3-and-4-platfrom cores, while the remaining 56.6% have cortex covering between 5 and 25% of their surfaces. The three cores coming from Rivolil Castelnuovo II contexts suggest a similar picture: one core is totally devoid of cortex and the remaining two (belonging to the Scaglia Variegata lithotype) have cortex covering between 5 and 25% of their surfaces.

The smallest removals left on these cores measure 10x7mm (RC I and RC II) whereas the largest are 35x19mm (RC I) and 14x18mm (RC II). The length/width ratio ranges from 0.4 (with small flakes, the widths of which are more than the lengths), to 1.8 (almost classifiable, as a blades). The majority (56%) of length/width ratios fall between 0.8 and 1.3, indicating that at the end of their life, three- and four-platform cores provided mostly small and broad flakes.

Flake cores are the most numerous of all core types at Rocca di Rivoli and provide an opportunity to have a more solid database for exploring flint knappers' habits. Flake cores receive less preparation overall: platforms might occasionally be abraded but the use of a hard hammer on an unprepared platform is the norm. The anvil technique is at times employed for this core category too, but not in association with a punch or pressure technique. Flake cores confirm the high exploitation rate which is a characteristic trait of all cores coming from Rocca di Rivoli deposits. There is only one exception in the entire assemblage, ID 4455, which was instrumental in throwing some light on core preparation techniques. Flake cores have up to 4 striking platforms, and exhibit at least 4 different knapping modes: unidirectional, multidirectional, simple-and-side (to the left and to the right), and simple-and-opposed. The amount of cortex left on them varies, but like other types of cores, very little survived, confirming once again the intention to get the most out of the piece of raw material being worked.

Cores: conclusions

On the basis of the information retrieved through the analysis of cores, it is possible to draw a tentative picture of the use of flint at Rocca di Rivoli, though this will have to be integrated with the information from analysis of the debitage. The vast majority of cores are associated with the Rivoli Castelnuovo I occupational phase, and very few with the Rivoli Castelnuovo II phase.

The greatest majority are flake cores, followed by mixed (blade-and-flake) cores, and extremely few blade core. All cores display a high degree of exploitation: roughly 80% of the total core assemblage display characteristics of exhaustion, i.e. no further flakes or blades could have been detached. Heavy exploitation is also reflected by core weight values and distribution (Fig. 6.3 and Table 6.4).

In general, it was observed that blade cores received a more careful platform preparation (such as overhang removal) in order to detach blades directly with a hard or soft hammer, rarely through pressure flaking. There might be two cases of thermal treatment (ID 4293, RC I and ID 4550, RC II), but these are rather ambiguous. Flake cores do not usually exhibit any platform preparation although it was noticed that striking platforms were at times roughly abraded. Knapping modes for flake cores are varied and aimed at getting the most out of the raw material available: different combinations of rotations, accompanied by the opening of *ad hoc* striking platforms, ensured that the entire surface of the core was used to extract flakes.

The incidence of mistakes within the core assemblage is rather high: 44% of the total number of cores display mistakes which considerably or completely compromised further knapping. At the same time, it should be borne in mind that the picture provided here is of the very last stage of core biography, when it becomes increasingly difficult to negotiate raw material constraints. Nonetheless, some of these mistakes suggest a low level of expertise since they were brought about by gross miscalculation of the direction, angle, and/or power of the blow. In particular, platform crushing and repeated steps on the debitage surface are often associated with the presence of learners negotiating the texture and mechanics of raw material as well as their own manual aptitude for knapping.

The next section explores data recorded for flakes and blades; the very products of cores. Through analysis of platform characteristics, dorsal morphology and the types of mistakes detectable on debitage, the story provided so far by the cores will be clarified and extended.

Debitage

Butt morphology provides data on how the core striking platform was prepared prior to detaching debitage. Knapping blades usually requires a higher degree of preparation and investment. Tables 8.15 and 8.16 present the distribution of the different types of butts on complete and proximal portions of blades from both archaeological phases at Rocca di Rivoli. Nearly 50% of blades from both periods have a simple butt, i.e. the cortex or natural surface was removed from the striking platform with one blow. More elaborate types of butts (e.g. linear, punctiform, facetted, dihedral), resulting from techniques requiring a higher degree of skill as well as additional investment (both time- and risk-wise), although present, make up a rather small part of the assemblage in the Rivoli Castelnuovo I phase (27.6 %) and decrease further (25%) in the later Rivoli Castelnuovo II phase. Corticated butts, associated with the earliest stages of core reduction, such as core *mise-en-forme* comprise respectively 9% (RC I) and 12.5% (RC II) of the entire blade assemblage.

Butt Type	RC I		RC II	
	Qty	%	Qty	%
Non identifiable	14	1.8%	2	1.4%
Corticated/unprepared	68	9.0%	18	12.5%
Simple (one removal)	378	49.9%	71	49.3%
Facetted	39	5.2%	5	3.5%
Dihedral	27	3.6%	2	1.4%
En chapeau de gendarme	7	0.9%	1	0.7%
Winged	5	0.7%	1	0.7%
Pecked	31	4.1%	11	7.6%
Spur/en eperons	3	0.4%		
Linear	51	6.7%	10	6.9%
Punctiform	51	6.7%	6	4.2%
Other				
Damaged	32	4.2%	5	3.5%
Abraded	50	6.6%	12	8.3%
Retouched	1	0.1%		
Total	*757*	*100.0%*	*144*	*100.0%*

Table. 8.15. Butt types on blades from Rivoli Castelnuovo I and II phases (quantity).

Butt Type	RC I		RC II	
	Qty	%	Qty	%
Non identifiable	13	0.5%	2	0.5%
Corticated/unprepared	358	13.0%	77	18.7%
Simple (one removal)	1478	53.7%	186	45.3%
Facetted	163	5.9%	21	5.1%
Dihedral	58	2.1%	4	1.0%
En chapeau de gendarme	4	0.1%		
Winged	192	7.0%	37	9.0%
Pecked	47	1.7%	3	0.7%
Spur/en eperons	10	0.4%	4	1.0%
Linear	14	0.5%	2	0.5%
Punctiform	3	0.1%	4	1.0%
Other				
Damaged	69	2.5%	24	5.8%
Abraded	340	12.4%	45	10.9%
Retouched	2	0.1%	2	0.5%
Total	*2751*	*100.0%*	*411*	*100.0%*

Table 8.16. Butt types on flakes from Rivoli Castelnuovo I and II phases (quantity).

When looking at flake debitage (Table 8.16) it is interesting to note that simple butts make up the majority of both assemblages, and that percentages are very close to those displayed by the unretouched blades. Simple butts comprise 45.3% of the assemblage from Rivoli Castelnuovo II, against 49.3% represented by the same type of butt type in the blade category. A similar picture is provided by more elaborate platform preparation efforts generating distinctive types of butts: facetted, dihedral, *en chapeau de gendarme*, winged, pecked, *en eperon*, linear, punctiform. Altogether, these count for 28.3% and 25% of Rivoli Castelnuovo I and II blade assemblages respectively. However, while these specific butts decrease to 17.8% in the Rivoli Castelnuovo I flake debitage assemblage, they go up to 27.3% for flakes from Rivoli Castelnuovo II contexts. Corticated or unprepared butts on unretouched flakes also increase slightly from 13% during Rivoli Castelnuovo I phase to 18.7%. in the later Rivoli Castelnuovo II phase.

Tables 8.17 to 8.20 give details of the different types of butts in relation to raw material types for both unretouched blades and flakes. Across the two phases and two artefact categories, simple butts characterise the majority of each assemblage. The Maiolica flint type, represents around or over 50% of these assemblages, and Scaglia Variegata between 20 and 40%. Debitage of Maiolica flint displays higher incidence of butts resulting from more elaborate techniques (e.g. punctiform or "en chapeau de gendarme") which in turns indicates that it was this raw material which was either chosen by more skilled flint knappers or preferred over the rest of the flint available when the knapping objective was the production of a precise type of artefact.

In addition to the type of butt, another four attributes were recorded in order to find out more information about the type of knapping techniques employed at Rocca di Rivoli: platform thickness, impact point, bulb of percussion, and *errailure* scar. Table 4.4 in Chapter 4,

Butt Type	Non identifiable		Oolitico di San Vigilio		Scaglia Rossa		Scaglia Variegata		Maiolica		Rosso Ammonitico		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable							1	0.13%	13	1.72%					14	1.85%
Corticated/unprepared	6	0.79%			2	0.26%	14	1.85%	44	5.81%			2	0.26%	68	8.98%
Simple (one removal)	19	2.51%			16	2.11%	83	10.96%	255	33.69%	1	0.13%	4	0.53%	378	49.93%
Facetted	5	0.66%			1	0.13%	8	1.06%	24	3.17%			1	0.13%	39	5.15%
Dihedral	1	0.13%			1	0.13%	7	0.92%	18	2.38%					27	3.57%
En chapeau de gendarme							1	0.13%	6	0.79%					7	0.92%
Winged	2	0.26%					2	0.26%	1	0.13%					5	0.66%
Pecked	4	0.53%			1	0.13%	8	1.06%	18	2.38%					31	4.10%
Spur/en eperons							1	0.13%	2	0.26%					3	0.40%
Linear	5	0.66%			4	0.53%	11	1.45%	29	3.83%			2	0.26%	51	6.74%
Punctiform	5	0.66%			1	0.13%	8	1.06%	37	4.89%					51	6.74%
Other																
Damaged	4	0.53%	1	0.13%	3	0.40%	3	0.40%	21	2.77%					32	4.23%
Abraded	4	0.53%	1	0.13%	1	0.13%	5	0.66%	38	5.02%			1	0.13%	50	6.61%
Retouched									1	0.13%					1	0.13%
Total	*55*	*7.27%*	*2*	*0.26%*	*30*	*3.96%*	*152*	*20.08%*	*507*	*66.97%*	*1*	*0.13%*	*10*	*1.32%*	*757*	*100.00%*

Table 8.17. Butt types of Rivoli Castelnuovo I unretouched blades according to raw material types (quantity).

Butt Type	Non identifiable		Scaglia Rossa		Scaglia Variegata		Maiolica		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable							2	1.39%			*2*	*1.39%*
Corticated/unprepared	3	2.08%			4	2.78%	11	7.64%			*18*	*12.50%*
Simple (one removal)	9	6.25%	2	1.39%	8	5.56%	51	35.42%	1	0.69%	*71*	*49.31%*
Facetted			1	0.69%			4	2.78%			*5*	*3.47%*
Dihedral	1	0.69%					1	0.69%			*2*	*1.39%*
En chapeau de gendarme							1	0.69%			*1*	*0.69%*
Winged							1	0.69%			*1*	*0.69%*
Pecked	3	2.08%	1	0.69%	4	2.78%	3	2.08%			*11*	*7.64%*
Spur/en eperons												
Linear	2	1.39%			2	1.39%	6	4.17%			*10*	*6.94%*
Punctiform					1	0.69%	5	3.47%			*6*	*4.17%*
Other												
Damaged	1	0.69%			2	1.39%	2	1.39%			*5*	*3.47%*
Abraded	3	2.08%			1	0.69%	8	5.56%			*12*	*8.33%*
Retouched												
Total	*22*	*15.28%*	*4*	*2.78%*	*22*	*15.28%*	*95*	*65.97%*	*1*	*0.69%*	*144*	*100.00%*

Table 8.18. Butt types of Rivoli Castelnuovo II unretouched blades according to raw material types (quantity).

Butt Type	Non identifiable		Oolitico di San Vigilio		Scaglia Rossa		Scaglia Variegata		Maiolica		Rosso Ammonitico		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable	1	0.04%			1	0.04%	2	0.07%	7	0.25%			2	0.07%	*13*	*0.47%*
Corticated/unprepared	29	1.05%	5	0.18%	31	1.13%	67	2.44%	223	8.11%			3	0.11%	*358*	*13.01%*
Simple (one removal)	147	5.34%	4	0.15%	100	3.64%	235	8.54%	968	35.19%	3	0.11%	21	0.76%	*1478*	*53.73%*
Facetted	12	0.44%	2	0.07%	10	0.36%	36	1.31%	101	3.67%			2	0.07%	*163*	*5.93%*
Dihedral	4	0.15%			2	0.07%	11	0.40%	40	1.45%			1	0.04%	*58*	*2.11%*
En chapeau de gendarme					1	0.04%			3	0.11%					*4*	*0.15%*
Winged	19	0.69%	1	0.04%	11	0.40%	33	1.20%	124	4.51%			4	0.15%	*192*	*6.98%*
Pecked	7	0.25%			1	0.04%	9	0.33%	30	1.09%					*47*	*1.71%*
Spur/en eperon							2	0.07%	7	0.25%			1	0.04%	*10*	*0.36%*
Linear	1	0.04%			2	0.07%	3	0.11%	8	0.29%					*14*	*0.51%*
Punctiform					1	0.04%	1	0.04%	1	0.04%					*3*	*0.11%*
Other																
Damaged	10	0.36%	2	0.07%	1	0.04%	5	0.18%	49	1.78%			2	0.07%	*69*	*2.51%*
Abraded	22	0.80%	3	0.11%	12	0.44%	46	1.67%	252	9.16%			5	0.18%	*340*	*12.36%*
Retouched									2	0.07%					*2*	*0.07%*
Total	*252*	*9.16%*	*17*	*0.62%*	*173*	*6.29%*	*450*	*16.36%*	*1815*	*65.98%*	*3*	*0.11%*	*41*	*1.49%*	*2751*	*100.00%*

Table 8.19. Butt types of Rivoli Castelnuovo I unretouched flakes according to raw material types (quantity).

Butt Type	Non identifiable		Oolitico di San Vigilio		Scaglia Rossa		Scaglia Variegata		Maiolica		Eocene		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable									2	0.49%			*2*	*0.49%*
Corticated/unprepared	11	2.68%			4	0.97%	11	2.68%	49	11.92%	2	0.49%	*77*	*18.73%*
Simple (one removal)	36	8.76%			5	1.22%	38	9.25%	106	25.79%	1	0.24%	*186*	*45.26%*
Facetted	2	0.49%	1	0.24%			5	1.22%	12	2.92%	1	0.24%	*21*	*5.11%*
Dihedral									4	0.97%			*4*	*0.97%*
En chapeau de gendarme														
Winged	7	1.70%			1	0.24%	9	2.19%	20	4.87%			*37*	*9.00%*
Pecked							3	0.73%					*3*	*0.73%*
Spur/en eperon							2	0.49%	2	0.49%			*4*	*0.97%*
Linear									2	0.49%			*2*	*0.49%*
Punctiform									3	0.73%	1	0.24%	*4*	*0.97%*
Other														
Damaged	2	0.49%					6	1.46%	16	3.89%			*24*	*5.84%*
Abraded	10	2.43%			2	0.49%	4	0.97%	29	7.06%			*45*	*10.95%*
Retouched							1	0.24%	1	0.24%			*2*	*0.49%*
Total	*68*	*16.55%*	*1*	*0.24%*	*12*	*2.92%*	*79*	*19.22%*	*246*	*59.85%*	*5*	*1.22%*	*411*	*100.00%*

Table 8.20 Butt types of Rivoli Castelnuovo II unretouched flakes according to raw material types (quantity).

summarised attributes associated with the different knapping modes. It is generally understood that the presence of an errailure scar and impact point, combined with a pronounced bulb of percussion, indicate the use of a hard hammer. The employment of a hard hammer is also associated with butts thicker than 1mm. A soft hammer produces a diffused bulb of percussion, thin platform (i.e. less than 1mm), and no impact point or errailure scar. Finally, the use of a punch is usually associated with a thin butt (less than 1mm), absence of an errailure scar and impact point, and the presence of a pronounced bulb of percussion. Table 8.21 below presents the results of an analysis of hammer types used to produce unretouched blades, based on identification of attributes described above.

As discussed in Chapter 4, attribution of knapping techniques is far from straightforward and traces left by different types of hammers might vary greatly depending on a number of factors, such as raw material qualities, power of blow, skill, etc. Although some caution is therefore necessary, exploration of knapping techniques attributes relating to the production of blades (Table 8.21) presents data in line with those coming from the analysis of knapping modes on core striking platforms, i.e. a hard hammer is most commonly employed in both phases. Figures for the use of hard and soft hammer in the production of Eocene flint blades (RC I) and Scaglia Variegata flint blades (RC II) differ slightly from the general trend. At the same time, overall sample size is much smaller than the rest and therefore less statistically reliable. Only a very few blades from Rivoli Castelnuovo I display traces that could point to the use of pressure flaking. This technique was not evident at all for Rivoli Castelnuovo II artefacts.

Unretouched blades	Hard hammer		Soft hammer		Punch/pressure		Non Identifiable		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Scaglia Variegata (RC I)	377	83.8%	49	10.9%	13	2.9%	11	2.4%	*450*	*100.0%*
Maiolica (RC I)	1363	75.1%	273	15.0%	110	6.1%	69	3.8%	*1815*	*100.0%*
Eocene (RC I)	17	41.5%	17	41.5%	5	12.2%	2	4.9%	*41*	*100.0%*
Total (RC I)	*1757*	*76.2%*	*339*	*14.7%*	*128*	*5.6%*	*82*	*3.6%*	*2306*	*100.0%*
Scaglia Variegata (RC II)	10	45.5%	12	54.5%					*22*	*100.0%*
Maiolica (RC II)	62	65.3%	25	26.3%			8	8.4%	*95*	*100.0%*
Total (RC II)	*72*	*61.5%*	*37*	*31.6%*			*8*	*6.8%*	*117*	*100.0%*

Table 8.21. Type of hammer used to knap unretouched blades from Rivoli Castelnuovo I and II (quantity).

A number of specific debitage categories were also selected in order to identify different reduction sequences and specific debitage products. Table 8.22 summarizes the two debitage assemblages in relation to the categories discussed in Chapter 4 (Table 4.32).

Knapping stage	Rivoli Castelnuovo I		Rivoli Castelnuovo II	
	Qty	%	Qty	%
Non Identifiable	8	0.26%	3	0.69%
Core Preparation	380	12.32%	87	19.95%
Core Reduction	1653	53.60%	188	43.12%
Rejuvenation of Debitage Surface	538	17.44%	83	19.04%
Bifacial preparation	76	2.46%	14	3.21%
Retouch flake	192	6.23%	29	6.65%
Platform trimming	168	5.45%	24	5.50%
Core tablets	26	0.84%	3	0.69%
Piece Esquillée	8	0.26%	1	0.23%
Burin spall	35	1.13%	3	0.69%
Other (specify in notes)			1	0.23%
Roughout				
Total	*3084*	*100.00%*	*436*	*100.00%*

Table 8.22. Distribution of flake type categories according to archaeological phase (numerical quantities, complete debitage only.

It is apparent from Table 8.22 that the majority of the debitage from both phases fall into the core reduction stage, followed by debitage resulting from episodes of rejuvenation (*remise-en-*

forme) and core preparation (including initial flaking). Although the discrepancy in size of the two samples demands caution, it is interesting to note that all stages are represented, with little to no variation from one phase to the other. It is also likely that retouch flakes and platform trimming flakes were under-represented. These can be very tiny and only systematic sieving (which was not undertaken during the 1963-1968 excavations) is likely to recover these types of finds.

Higher percentages of debitage of all lithotypes fall into the core reduction category. (Table 8.23). While Scaglia Rossa debitage from Rivoli Castelnuovo I deposits and Maiolica debitage from Rivoli Castelnuovo II layers present slightly higher percentage of debitage associated with the core preparation stage (16.9% and 21.6% respectively). Debitage resulting from core rejuvenation also displays a higher incidence in the case of Scaglia Variegata flint. It is interesting to note that Eocene flint debitage (RC I) presents different patterns when it comes to flakes resulting from the trimming of bifaces (6.4% compared to between 2.1% and 4.4% of the other raw material assemblages) and artefact retouching (12.6% compared to between 3.8% and 7.3% of the overall assemblage). Finally, some specific debitage types are totally absent from certain assemblages. For instance core tablets do not seem to be part of Eocene (RC I) or Scaglia Variegata (RC II) core rejuvenation strategies. Similarly, *piéces escailleés* do not feature among debitage belonging to the Scaglia Variegata (RC I) or Maiolica (RC II) flint types. Tables 8.24 to 8.29, along with Figures 8.3 to 8.5, look closer at the relationship between knapping stage, raw material and debitage size.

Knapping stage	Rivoli Castelnuovo I				Rivoli Castelnuovo II	
	Maiolica	Scaglia Variegata	Scaglia Rossa	Eocene	Maiolica	Scaglia Variegata
Core Preparation	12.0%	12.2%	16.9%	10.6%	21.6%	10.0%
Core Reduction	54.3%	52.7%	50.3%	55.3%	43.6%	48.8%
Rejuvenation of Debitage Surface	17.4%	21.5%	12.6%	8.5%	16.5%	26.3%
Bifacial preparation	2.5%	2.1%	2.7%	6.4%	4.4%	2.5%
Retouch flake	5.8%	5.7%	7.1%	12.8%	7.3%	3.8%
Platform trimming	5.6%	3.8%	8.7%	2.1%	4.4%	6.3%
Core tablets	1.0%	0.4%	1.1%		1.1%	
Piece Esquillée	0.3%		0.5%	2.1%		1.3%
Burin spall	1.1%	1.7%		2.1%	0.7%	1.3%
Other (specify in notes)					0.4%	
Roughout						
Total	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Table 8.23. Distribution of debitage flake types according to archaeological phase and the most common lithotypes (numerical quantities, complete artefacts only).

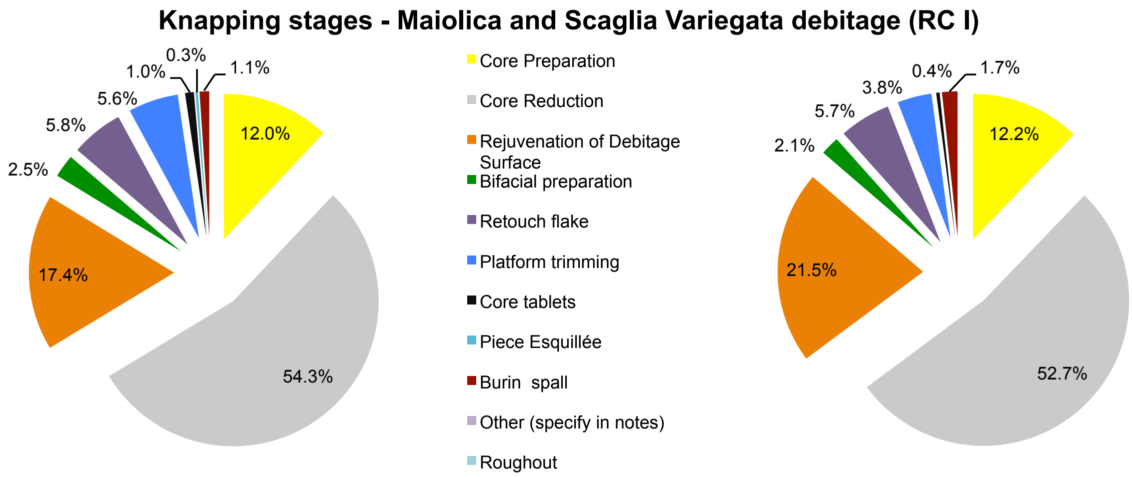


Fig. 8.3. Distribution of debitage flake types: on left Maiolica flint and on right Scaglia Variegata flint (numerical quantities, complete artefacts only).

Knapping stage	Macro-flake		Very large flake		Large flake		Flake		Blade-like-Flake		Blade		Bladelet		Microblade		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Core Preparation	1	0.05%	12	0.59%	23	1.12%	51	2.49%	113	5.52%	39	1.91%	7	0.34%			246	12.0%
Core Reduction			39	1.91%	128	6.25%	221	10.80%	519	25.35%	167	8.16%	38	1.86%			1112	54.3%
Rejuvenation of Debitage Surface			13	0.64%	18	0.88%	58	2.83%	195	9.53%	57	2.78%	14	0.68%	1	0.05%	356	17.4%
Bifacial preparation			1	0.05%	6	0.29%	13	0.64%	29	1.42%	3	0.15%					52	2.5%
Retouch flake			6	0.29%	15	0.73%	21	1.03%	61	2.98%	13	0.64%	3	0.15%			119	5.8%
Platform trimming	1	0.05%	11	0.54%	26	1.27%	27	1.32%	47	2.30%	2	0.10%					114	5.6%
Core tablets			4	0.20%	6	0.29%	2	0.10%	6	0.29%	2	0.10%					20	1.0%
Piece Esquillée					1	0.05%	2	0.10%	3	0.15%							6	0.3%
Burin spall									9	0.44%	3	0.15%	8	0.39%	2	0.10%	22	1.1%
Other (specify in notes)																		
Roughout																		
Total	*2*	*0.10%*	*86*	*4.20%*	*223*	*10.89%*	*395*	*19.30%*	*982*	*47.97%*	*286*	*13.97%*	*70*	*3.42%*	*3*	*0.15%*	*2047*	*100.0%*

Table 8.24 Distribution of debitage flake types according to Bagolini's (1968) categories. Maiolica flint, Rivoli Castelnuovo I (complete artefacts only).

Knapping stage	Macro-flake		Very large flake		Large flake		Flake		Blade-like-Flake		Blade		Bladelet		Microblade		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Core Preparation			4	0.76%	6	1.14%	9	1.71%	27	5.13%	18	3.42%					64	12.2%
Core Reduction			17	3.23%	34	6.46%	54	10.27%	128	24.33%	38	7.22%	6	1.14%			277	52.7%
Rejuvenation of Debitage Surface			2	0.38%	4	0.76%	17	3.23%	55	10.46%	24	4.56%	10	1.90%	1	0.19%	113	21.5%
Bifacial preparation					2	0.38%	1	0.19%	8	1.52%							11	2.1%
Retouch flake					3	0.57%	8	1.52%	16	3.04%	3	0.57%					30	5.7%
Platform trimming			3	0.57%	6	1.14%	3	0.57%	8	1.52%							20	3.8%
Core tablets							1	0.19%	1	0.19%							2	0.4%
Piece Esquillée																		
Burin spall									4	0.76%			4	0.76%	1	0.19%	9	1.7%
Other (specify in notes)																		
Roughout																		
Total			*26*	*4.94%*	*55*	*10.46%*	*93*	*17.68%*	*247*	*46.96%*	*83*	*15.78%*	*20*	*3.80%*	*2*	*0.38%*	*526*	*100.0%*

Table 8.25. Distribution of debitage flake types according to Bagolini's (1968) categories. Scaglia Variegata flint, Rivoli Castelnuovo I (complete artefacts only).

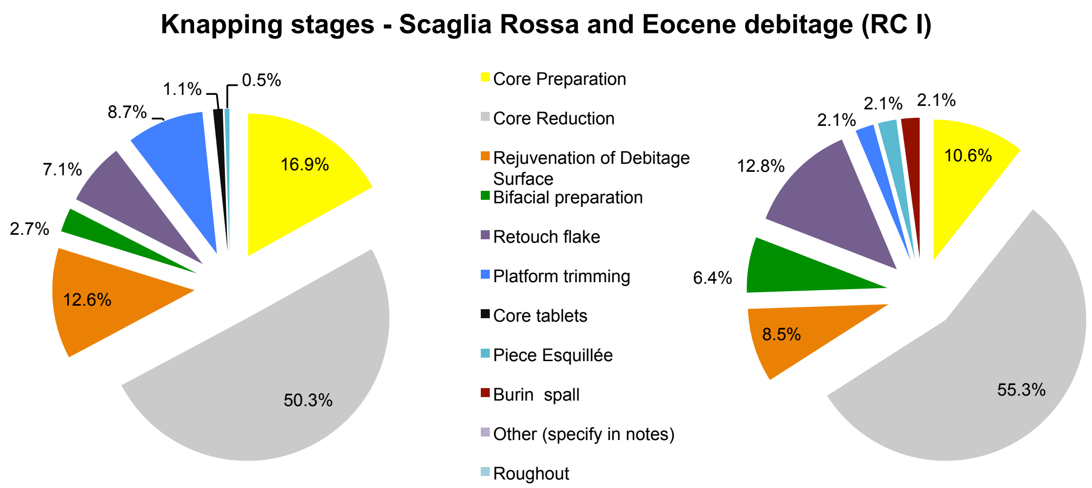


Fig. 8.4. Distribution of debitage flake types. Left: Scaglia Rossa flint. Right: Eocene flint. Numerical quantities, complete artefacts only.

Knapping Stage	Macro-flake		Very large flake		Large flake		Flake		Blade-like-Flake		Blade		Bladelet		Microblade		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Core Preparation			1	0.55%	5	2.73%	5	2.73%	16	8.74%	3	1.64%	1	0.55%			31	16.9%
Core Reduction			1	0.55%	9	4.92%	13	7.10%	57	31.15%	9	4.92%	2	1.09%	1	0.55%	92	50.3%
Rejuvenation of Debitage Surface			1	0.55%	2	1.09%	5	2.73%	14	7.65%	1	0.55%					23	12.6%
Bifacial preparation							1	0.55%	4	2.19%							5	2.7%
Retouch flake					1	0.55%	2	1.09%	10	5.46%							13	7.1%
Platform trimming			1	0.55%	1	0.55%	3	1.64%	11	6.01%							16	8.7%
Core tablets					1	0.55%	1	0.55%									2	1.1%
Piece Esquillée							1	0.55%									1	0.5%
Burin spall																		
Other (specify in notes)																		
Roughout																		
Total			*4*	*2.19%*	*19*	*10.38%*	*31*	*16.94%*	*112*	*61.20%*	*13*	*7.10%*	*3*	*1.64%*	*1*	*0.55%*	*183*	*100.0%*

Table 8.26. Distribution of debitage flake types according to Bagolini's (1968) categories. Scaglia Rossa flint, Rivoli Castelnuovo I (complete artefacts only).

Knapping stage	Macro-flake		Very large flake		Large flake		Flake		Blade-like-Flake		Blade		Bladelet		Microblade		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Core Preparation					1	2.13%			2	4.26%	1	2.13%	1	2.13%			5	10.6%
Core Reduction					2	4.26%	4	8.51%	17	36.17%	2	4.26%	1	2.13%			26	55.3%
Rejuvenation of Debitage Surface							1	2.13%	1	2.13%	1	2.13%	1	2.13%			4	8.5%
Bifacial preparation					2	4.26%			1	2.13%							3	6.4%
Retouch flake							1	2.13%	5	10.64%							6	12.8%
Platform trimming									1	2.13%							1	2.1%
Core tablets																		
Piece Esquillée			1	2.13%													1	2.1%
Burin spall													1	2.13%			1	2.1%
Other (specify in notes)																		
Roughout																		
Total			*1*	*2.13%*	*5*	*10.64%*	*6*	*0.128*	*27*	*57.45%*	*4*	*8.51%*	*4*	*8.51%*			*47*	*100.0%*

Table 8.27. Distribution of debitage flake types according to Bagolini's (1968) categories. Eocene flint, Rivoli Castelnuovo I (complete artefacts only).

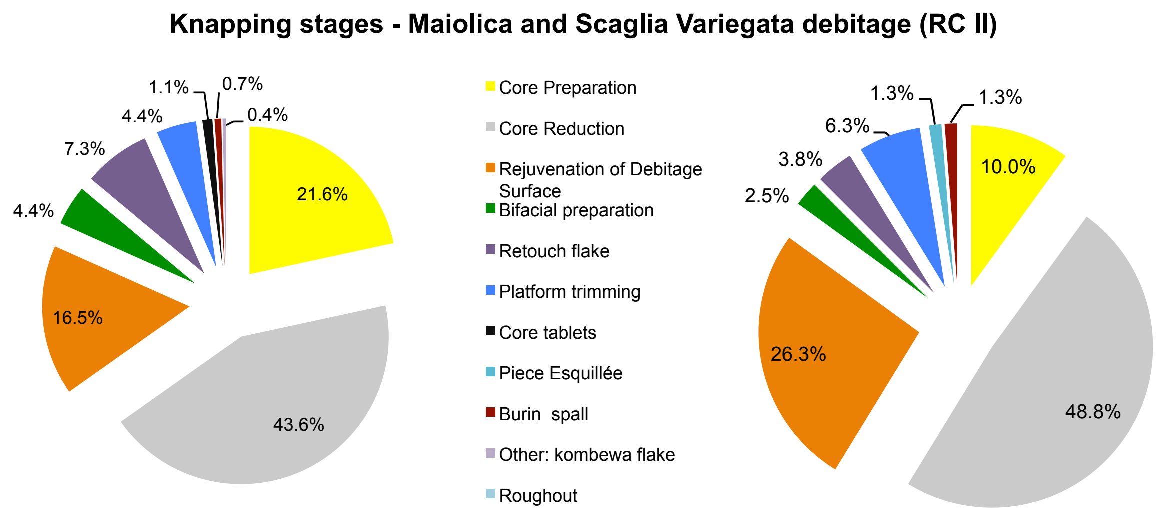


Fig. 8.5. Distribution of debitage flake types: on left Maiolica flint and on right Scaglia Variegata flint (numerical quantities, complete artefacts only).

Knapping stage	Macro-flake		Very large flake		Large flake		Flake		Blade-like-Flake		Blade		Bladelet		Microblade		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Core Preparation	1	0.37%	7	2.56%	13	4.76%	12	4.40%	13	4.76%	13	4.76%					59	21.6%
Core Reduction	1	0.37%	7	2.56%	24	8.79%	39	14.29%	24	8.79%	19	6.96%	5	1.83%			119	43.6%
Rejuvenation of Debitage Surface			4	1.47%	7	2.56%	13	4.76%	7	2.56%	10	3.66%	4	1.47%			45	16.5%
Bifacial preparation			1	0.37%	1	0.37%	5	1.83%	5	1.83%							12	4.4%
Retouch flake			1	0.37%	1	0.37%	7	2.56%	7	2.56%	2	0.73%	2	0.73%			20	7.3%
Platform trimming			3	1.10%	8	2.93%			1	0.37%							12	4.4%
Core tablets							3	1.10%									3	1.1%
Piece Esquillée																		
Burin spall											1	0.37%	1	0.37%			2	0.7%
Other: kombewa flake							1	0.37%									1	0.4%
Roughout																		
Total	*2*	*0.73%*	*23*	*8.42%*	*54*	*19.78%*	*80*	*29.30%*	*57*	*20.88%*	*45*	*16.48%*	*12*	*4.40%*			*273*	*100.0%*

Table 8.28. Distribution of debitage flake types according to Bagolini's (1968) categories. Maiolica flint, Rivoli Castelnuovo II (complete artefacts only).

Knapping stage	Macro-flake		Very large flake		Large flake		Flake		Blade-like-Flake		Blade		Bladelet		Microblade		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Core Preparation					1	1.3%	3	3.8%	2	2.5%	2	2.5%					8	10.0%
Core Reduction			1	1.3%	8	10.0%	14	17.5%	11	13.8%	4	5.0%	1	1.3%			39	48.8%
Rejuvenation of Debitage Surface			1	1.3%	1	1.3%	7	8.8%	6	7.5%	6	7.5%					21	26.3%
Bifacial preparation					1	1.3%	1	1.3%									2	2.5%
Retouch flake							1	1.3%	1	1.3%	1	1.3%					3	3.8%
Platform trimming			1	1.3%	2	2.5%	2	2.5%									5	6.3%
Core tablets																		
Piece Esquillée							1	1.3%									1	1.3%
Burin spall					1	1.3%											1	1.3%
Other (specify in notes)																		
Roughout																		
Total			*3*	*3.8%*	*14*	*17.5%*	*29*	*36.3%*	*20*	*25.0%*	*13*	*16.3%*	*1*	*1.3%*			*80*	*100.0%*

Table 8.29. Distribution of debitage flake types according to Bagolini's (1968) categories.Scaglia Variegata flint, Rivoli Castelnuovo II (complete artefacts only).

It is evident from Tables 8.24 and 8.25 that Maiolica and Scaglia Variegata debitage assemblages from Rivoli Castelnuovo I are quite similar. There is one exception; namely the higher proportion of Scaglia Variegata core preparation blades (3.42%) compared with 1.9% Maiolica blades. The Scaglia Rossa and Eocene debitage assemblages are very different: although one needs to bear in mind their smaller sample size, it is immediately noticeable how Scaglia Rossa debitage is characterised by higher percentages of flakes and blade-like-flakes (Table 8.26) when compared with the other three raw material types.

A few differences are also apparent when comparing Tables 8.24 and 8.25 (Maiolica and Scaglia Variegata debitage from Rivoli Castelnuovo I contexts) with Tables 8.28 and 8.29 (Maiolica and Scaglia Variegata debitage from Rivoli Castelnuovo II contexts). The increase in overall core preparation debitage for the Maiolica assemblage is especially striking: from 12.0% during the earlier phase to 21.6% in the later phase. Both assemblages (Maiolica and Scaglia Variegata) see an increase of flakes (Maiolica: from 17.68% to 36.3%; Scaglia Variegata: from 19.30% to 29.30%) and a drop in blade-like-flakes (Maiolica, from 47.97% to 20.88%; Scaglia Variegata, from 46.96% to 25.0%) from the earlier to the later phase. Other differences are noticeable in the increase of large Scaglia Variegata flakes (from 10.46% to 17.5%) and an increase in Maiolica blades (from 13.97% to 16.48%) from the Rivoli Castelnuovo I to the Rivoli Castelnuovo II phase.

Another attribute recorded for both flakes and blades is dorsal morphology. The direction and type of scars identified on the dorsal surface provide information on core biography and technological choices made by the knapper. Tables 8.30 and 8.31 provide details of dorsal morphology recorded on unretouched flakes and blades.

It is evident from Table 8.30 that the greatest majority of debitage from Rivoli Castelnuovo I deposits, whether blades or flakes, was produced through unidirectional knapping. Dorsal morphology signalling change of direction or core rotation during knapping (i.e. side DX, side SX, random, unidirectional-side DX, unidirectional-side SX, opposed, opposed-side DX, opposed-side SX, unidirectional-opposed, opposed-unidirectional), is recorded on roughly the same percentage of flakes regardless of raw material type: 12.27% for Scaglia Rossa, 12.75% for Scaglia Variegata and 12.92% for Maiolica. As regards blades, change of direction or knapping sequence is apparent on only 4.24% of Scaglia Variegata and 5.01% of Maiolica unretouched blades coming from Rivoli Castelnuovo I deposits.

Table 8.31 presents dorsal morphology data from debitage belonging to the Rivoli Castelnuovo II occupational phase. For this phase too, the majority of debitage, both blades or flakes, was produced through unidirectional knapping. Dorsal morphology signalling change of direction or core rotation during knapping is recorded on 17.9% and 6.29% of Scaglia Variegata flakes and

Dorsal Morphology	Flakes						Blades			
	Scaglia Rossa		Scaglia Variegata		Maiolica		Scaglia Variegata		Maiolica	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable	7	4.29%	29	7.11%	112	6.80%	3	2.54%	15	3.76%
Unidirection	105	64.42%	268	65.69%	1030	62.50%	77	65.25%	298	74.69%
Opposed	1	0.61%			12	0.73%			4	1.00%
SideDX	3	1.84%	9	2.21%	34	2.06%			1	0.25%
SideSX	3	1.84%	10	2.45%	38	2.31%			2	0.50%
Radial					3	0.18%				
Random	5	3.07%	2	0.49%	46	2.79%	1	0.85%	2	0.50%
Convergent	4	2.45%	18	4.41%	71	4.31%	1	0.85%	4	1.00%
Step	14	8.59%	18	4.41%	88	5.34%	4	3.39%	16	4.01%
Damaged	3	1.84%	9	2.21%	30	1.82%	1	0.85%	1	0.25%
Crested			1	0.25%	6	0.36%	7	5.93%	5	1.25%
Unidirectional-SideDX	1	0.61%	3	0.74%	21	1.27%	2	1.69%	2	0.50%
Unidirectional-SideSX	3	1.84%	6	1.47%	44	2.67%			7	1.75%
Opposed-SideDX			4	0.98%						
Opposed-SideSX			1	0.25%	1	0.06%			1	0.25%
UpsylonProximal	1	0.61%	2	0.49%	2	0.12%	9	7.63%	20	5.01%
UpsylonDistal					1	0.06%	1	0.85%	5	1.25%
Other									1	0.25%
Cortical	6	3.68%	10	2.45%	40	2.43%	10	8.47%	7	1.75%
Unidirectional-opposed	2	1.23%	5	1.23%	16	0.97%	2	1.69%	2	0.50%
Opposed-unidirectional	2	1.23%	1	0.25%	6	0.36%			2	0.50%
Side DX-side SX	1	0.61%	1	0.25%	7	0.42%			1	0.25%
Repeated step fractures	2	1.23%	11	2.70%	40	2.43%			3	0.75%
Total	*163*	*100.00%*	*408*	*100.00%*	*1648*	*100.00%*	*118*	*100.00%*	*399*	*100.00%*

Table 8.30. Dorsal morphology recorded on selected debitage from Rivoli Castelnuovo I deposits (complete artefacts only, numerical quantity).

Dorsal Morphology	Flakes				Blades			
	Scaglia Variegata		Maiolica		Scaglia Variegata		Maiolica	
	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable	1	1.56%					2	3.28%
Unidirection	42	65.63%	122	57.82%	11	68.75%	38	62.30%
Opposed			2	0.95%			1	1.64%
SideDX	2	3.13%	5	2.37%			2	3.28%
SideSX	1	1.56%	4	1.90%				
Radial			1	0.47%				
Random	1	1.56%	5	2.37%				
Convergent	2	3.13%	16	7.58%				
Step	3	4.69%	20	9.48%	2	12.50%	3	4.92%
Damaged	2	3.13%	6	2.84%				
Crested							2	3.28%
Unidirectional-SideDX	4	6.25%	6	2.84%	1	6.25%	1	1.64%
Unidirectional-SideSX	1	1.56%	1	0.47%				
Opposed-SideDX			3	1.42%				
Opposed-SideSX								
UpsylonProximal					1	6.25%	5	8.20%
UpsylonDistal			1	0.47%	1	6.25%	1	1.64%
Other								
Cortical	1	1.56%	9	4.27%			3	4.92%
Unidirectional-opposed	2	3.13%	4	1.90%			1	1.64%
Opposed-unidirectional			1	0.47%			2	3.28%
Side DX-side SX			3	1.42%				
Repeated step fractures	2	3.13%	2	0.95%				
Total	*64*	*100.00%*	*211*	*100.00%*	*16*	*100.00%*	*61*	*100.00%*

Table 8.31. Dorsal morphology recorded on selected debitage from Rivoli Castelnuovo II deposits (complete artefacts only, numerical quantity).

blades respectively, whereas for the Maiolica lithotype it is detectable on 15.17% and 9.84% of flakes and blades respectively.

The percentages of debitage displaying mistakes is summarized in Table 8.32. Mistakes are present on roughly 15% of unretouched blades and 19% of unretouched flakes coming from the Rivoli Castelnuovo I phase. The most common mistake evident from blades of this phase is plunging (6.92%), followed by the presence of a lipped bulb (4.50%). However, in the case of plunging, experimental replication showed that this is a particularly effective strategy employed to rejuvenate the knapping angle and the debitage surface during core *remise-en-forme*. It is therefore probable that Rocca di Rivoli knappers used this rejuvenation technique and not all of the plunging blades were accidentally produced. The most common mistake evident from unretouched flakes from Rivoli Castelnuovo I deposits is a hinged termination (13.57%), resulting from a miscalculation of angle and power of blow (which appears a step fracture on the core debitage surface).

Accident Type	Rivoli Castelnuovo I				Rivoli Castelnuovo II			
	Blades		Flakes		Blades		Flakes	
	Qty	%	Qty	%	Qty	%	Qty	%
None	487	84.26%	2040	81.40%	68	73.12%	255	74.34%
Languette								
Nacelle			3	0.12%				
Plunged	40	6.92%	38	1.52%	15	16.13%	9	2.62%
Hinged	23	3.98%	340	13.57%	6	6.45%	60	17.49%
Incipient cone(s) on striking plt			7	0.28%	1	1.08%		
Lipped bulb	26	4.50%	60	2.39%	3	3.23%	12	3.50%
Siret			1	0.04%				
Other (specify in notes)								
Crushed platform	2	0.35%	14	0.56%			6	1.75%
Overhanging platform			3	0.12%			1	0.29%
Total	*578*	*100.00%*	*2506*	*100.00%*	*93*	*100.00%*	*343*	*100.00%*

Table 8.32. Types of knapping accidents recorded on complete debitage coming from Rivoli Castelnuovo I and II deposits (numerical quantity).

In Rivoli Castelnuovo II contexts, the overall incidence of mistakes increased to affect around 26% of both unretouched blades (26.88%) and flakes (25.66%). Plunging is still the most common mistake recorded on blades and its incidence more than doubled from the previous occupational phase: from 6.92% to 16.13%. Similarly, hinged terminations were recorded on 6.45% of unretouched blades (against 3.98% of the Rivoli Castelnuovo I blade assemblage), and hinged terminations also affected flake production (17.49%).

The systematic recording of dorsal morphology (e.g. presence of step and repeated steps) and knapping mistakes provides a general idea of the level of skill displayed by knappers at Rocca di Rivoli. Under the entries “step” and “repeated steps”, Tables 8.30 and 8.31 identify debitage displaying mistakes on their dorsal face. In the case of flakes and blades from Rivoli Castelnuovo I contexts, stepped scars on the dorsal surface are present on 4.41% of the flakes and 3.39% of the blades belonging to the Scaglia Variegata lithotype, and 5.34% of the flakes and 4.01% of the blades belonging to the Maiolica raw material type. Repeated steps were recorded not only on Scaglia Variegata flakes (2.70%) but also on both Maiolica flakes (2.43%) and blades (0.75%). Both assemblages display a rather high degree of success in recovering from these specific mistakes. Maiolica and Scaglia Variegata flakes register around 70% success rate (Fig. 8.6). As for blades, all Scaglia Variegata blades (only 4) recuperated the mistakes completely. Out of 19 Maiolica blades, 14 (74%) did not result in another mistake, 3 (16%) resulted in a hinged blade (same mistake again) and 2 (11%) ended up with a different mistake (plunging).

Fig. 8.6. Overcoming knapping mistakes on Maiolica (left) and Scaglia Variegata (right) flakes displaying step & repeated steps on dorsal morphology (complete artefacts only, Rivoli Castelnuovo I).

In the case of flakes and blades coming from Rivoli Castelnuovo II contexts, stepped scars on the dorsal surface are present on 4.69% and 12.50% of Scaglia Variegata flakes and blades respectively, and on 9.48% and 4.92% of Maiolica flakes and blades respectively. Repeated steps were recorded only on Scaglia Variegata flakes (3.13%) and Maiolica flakes (0.95%). When comparing the degree of success in recovering from mistakes, it was noted that of 27 debitage pieces removed immediately after a mistake was made, 18 (66%) did not result in another mistake, 8 (30%) resulted in a hinged flake/blade (same mistake again) and 1 (4%) ended up with a different mistake (crushed platform).

Debitage: conclusions

Analysis of debitage attributes provides additional information to that supplied by the observation of cores. Some results confirm or complement the picture outlined on the basis of the results obtained from the core analysis, while others add a different perspective and generate further questions about the technological choices made by the knappers on the Rocca di Rivoli.

As regards knapping techniques, the high number of blade and flake cores with one striking platform was matched with the picture supplied by the dorsal morphology attributes of both blades and flakes: the majority of debitage displays unidirectional scars. Most debitage (both blades and flakes) was struck with a hard hammer. Platform preparation in most cases was achieved through the removal of a single flake, providing a flat and as smooth a striking platform as possible. Although not that common, some abrasion of the core cornice took place. Elaborate platform preparation, leading to the debitage displaying specific butt morphology (e.g. diheadral, facetted, punctiform, "*en chapeu de gendarme*" etc.) did take place although this is not specifically linked to the production of blades or blade-like-flakes, but was also present on flakes. It is interesting to note that flake butts from Rivoli Castelnuovo II contexts associated with more elaborate knapping techniques outnumber those recorded on blades from the same phase: 27.3% to 25%. For Rivoli Castelnuovo I the proportions are respectively 28.3% of blades and 17.8% of flakes. It is possible that this change in knapping techniques indicates a change in debitage production and knapping organization, although it could also be related to the level of skill on behalf of the knappers.

Assessment of the different knapping stages documented by the presence of specific debitage types (Table 8.22) shows that all stages of an hypothetical *chaîne opératoire* are represented at Rocca di Rivoli throughout both occupational phases. Percentages do vary from one phase to the other and this might suggest a change in the way of doing things. For instance, core preparation seems to become a prominent knapping stage during the Rivoli Castelnuovo II phase, accounting for more than 20% of the total debitage, which raises the question of why cores (or more cores) were prepared on the Rocca and not at the outcrop location. During Rivoli Castelnuovo II there was also a decisive shift towards flake production and the production of blades generally saw less investment (mainly having simple butts, with little or no preparation on blade cores).

Debitage belonging to the Maiolica flint type displays a higher incidence of butts associated with elaborate knapping techniques. Probably, as discussed in Chapter 7, Maiolica flint remained the preferred raw material because of its superior quality and generally easy access. However, it also appears to have been the chosen raw material to display skill and accuracy through the production of aesthetically pleasing products, the attributes of which were subject to a greater investment in terms of knowledge, experience and time.

The systematic recording of dorsal morphology (e.g. presence of steps and repeated steps) and knapping mistakes provided a general sense of the level of skill displayed by knappers at Rocca di Rivoli, as well as some of the strategies put in place to recuperate common mistakes. It is difficult to understand whether the knapping error percentages recorded for the lithic sample from Rocca di Rivoli are representative of mistake rates for a VBQ III site, since no other data of this type are available. Studies of error frequencies among modern day flint knappers are also not available. However, when asked separately, two modern day knappers (Claudio Isotta, pers. comm. 2012, Giorgio Chelidonio, pers. comm. 2009) agreed that no more than a 10% error rating is acceptable for experienced knappers. Data resulting from debitage analysis at Rocca di Rivoli supplied percentages slightly higher than this (see above), along with a number of mistakes which are especially associated with inexperienced knapping (platform crushing, repeated steps on debitage surface).

The initial flaking and core reduction analytical stage offered additional insights into the knapping process at Rocca di Rivoli. Some of the decision making by the knappers emerged from the mass of data collected, generating a series of new questions that the next section will address.

Conclusion: technological practice and *chaînes opératoires*

A total of 16 operational sequences were identified on the basis of the analyses undertaken on cores and debitage (Figs. 8.7 to 8.9). Because of the nature of the archaeological record at Rocca di Rivoli (secondary deposition in pits, no refits) these *chaînes opératoires* are to be considered basic frameworks allowing for endless variations and additions taking place during the unfolding of flint knapping activities. Technological practice should be thought of in a fluid way, an activity during which not only the raw material is negotiated and the suitability of the next action assessed according to a set of implicit or explicit "rules", but where knappers relate to each other, discuss strategies and needs, improvise and try out different techniques whilst engaging in different forms of social interaction. For instance, the use of a hard or soft hammer might be alternated in the hands of the expert knapper, so that a knapping process might indeed witness the use of different types of hammers at different times. Similarly, an anvil might be employed in combination with the use of a punch or a soft hammer for only a few strikes.

The majority of knapping at Rocca di Rivoli took place through the reduction of one-platform cores, be it for the production of blades, flakes or both (mixed cores). Both assemblages (Rivoli Castelnuovo I and II) are characterised by the predominant use of the hard hammer. Soft hammers (organic material such as antler or bone but also soft stone, as for example limestone or tufa) were also employed, especially in association with the production of blades, whereas indirect flaking by means of a punch was rare during the Rivoli Castelnuovo I phase and restricted to the production of blades. There is only one blade core (see above) from Rivoli Castelnuovo II which bears traces of pressure flaking, but it remains an isolated example since no debitage from this phase shows attributes associated with this type of technique.

Platform preparation is in general more elaborate on blade cores, where there are traces of overhang removal and abrasion. There might be one or two examples of thermal treatment, associated with the production of blades, but these were detected only on cores with no correspondence on blades. The majority of debitage, including blades, displays simple platform preparation consisting of single flake removals or, although not that common, abrasion. The knowledge and skill required for the production of more elaborate knapping sequences evident on blades with more labour-intensive butts (e.g. punctiform, facetted, linear etc.) survive but are no longer featuring only on blades but also on flakes. It would seem that the distinction between the two different types of products, flakes and blades, at least from the technical investment point of view, starts to blur during the Rivoli Castelnuovo II phase. This phenomenon also coincides with a focus on knapping flake blanks for the production of bifacially retouched artefacts. Although blades produced during the later phase of the VBQ are generally held to be of good manufacture standards (Dal Santo 2005: 183), it is suggested here (further discussed in Chapter 9) that knappers' expertise at Rocca di Rivoli starts shifting towards the production of bifacially retouched artefacts.

Results from debitage analysis also suggest that there is an increase in corticated debitage during the later phase of Rivoli Castelnuovo II, indicating the prominence of the core preparation knapping stage on the Rocca. This might suggest a change in the organization of work and responsibilities relating to how raw material reached the site and subsequent core shaping strategies. In general, cores from Rivoli Castelnuovo II phase were mostly discarded after having been thoroughly exploited: their average weight is 25.55g compared to 40.02g for cores from the Rivoli Castelnuovo I context (31.42g, if the outlier ID 4455 is taken out). It is notable that more than 80% of Rivoli Castelnuovo II cores display cortex cover only up to 25% of the core surface. Removing cortex from cores became an even more important goal during the later phase of Rivoli Castelnuovo II and this might, again, relate to the final artefacts the knapper was producing.

Another figure which is particularly interesting is the increase in knapping mistakes during the later phase of Rivoli Castelnuovo II (Table 8.32). There are different hypothesis which can explain this increase. Firstly, it might relate to the quality of the raw material being used. At the same time, it was pointed out that during the later phase knappers chose deliberately to use only Maiolica and Scaglia Variegata flint, the two best raw material types available, and leave aside other, less good, flint varieties. Secondly, it might relate to the loss of knowledge and manual skills, i.e. knappers either did not possess the skills required (*connaissance* and *savoir-faire*) or did not care about continuing a certain tradition (i.e. it was acceptable to produce less usable artefacts and make more mistakes). This is difficult to assess, especially when techniques existing in the previous phase, although no longer common, were still present. At the same time, one wonders whether the higher percentage of blade and mixed cores recorded in Rivoli Castelnuovo II contexts (Figs. 8.1 and 8.2) might be related to this shift in perceived values. During this phase there are proportionally more blade cores and mixed cores (quantity and weight wise) than flake cores, but the percentage of flakes remains higher than blades. More frequent mistakes and a decline in skills to produce blades might account for the discrepancy between cores and debitage. Thirdly, an increase in the rate of knapping mistakes might reflect an increase in the presence of apprentices, or more freedom in negotiating raw material constraints and techniques and making mistakes.

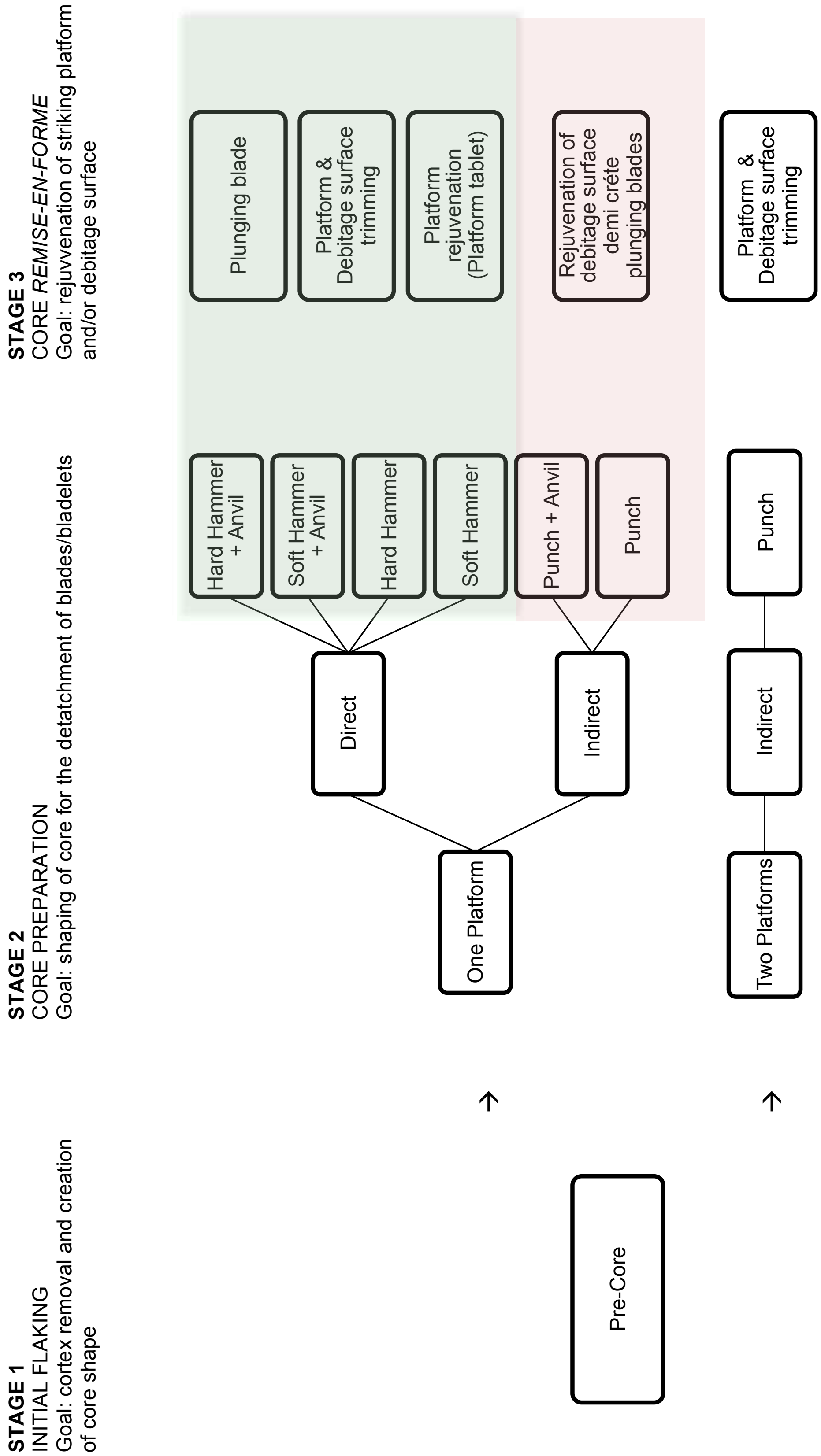


Fig. 8.7. Schematic representation of blade core *chaînes opératoires* at Rocca di Rivoli

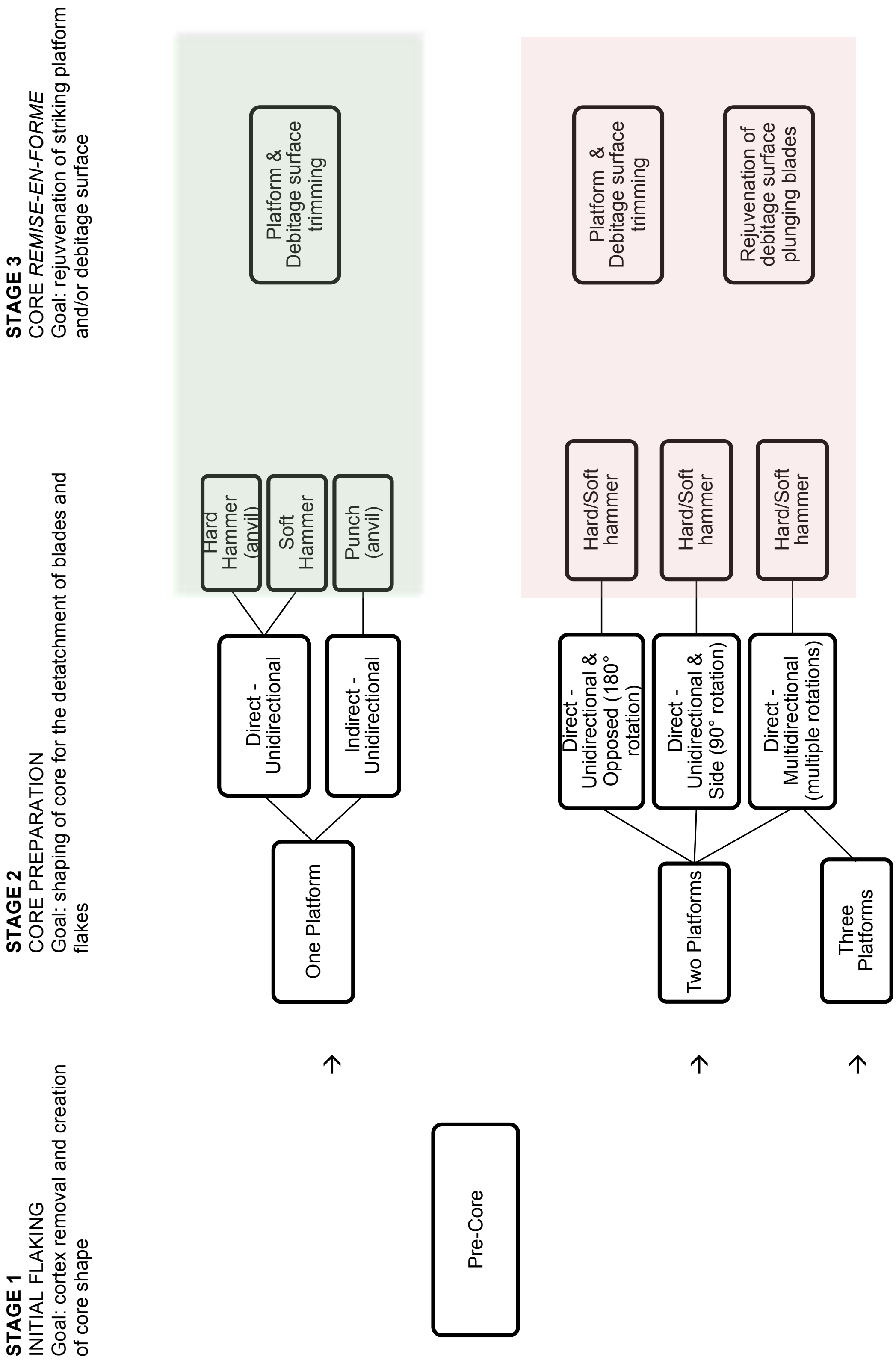


Fig. 8.7. Schematic representation of mixed core *chaînes opératoires* at Rocca di Rivoli

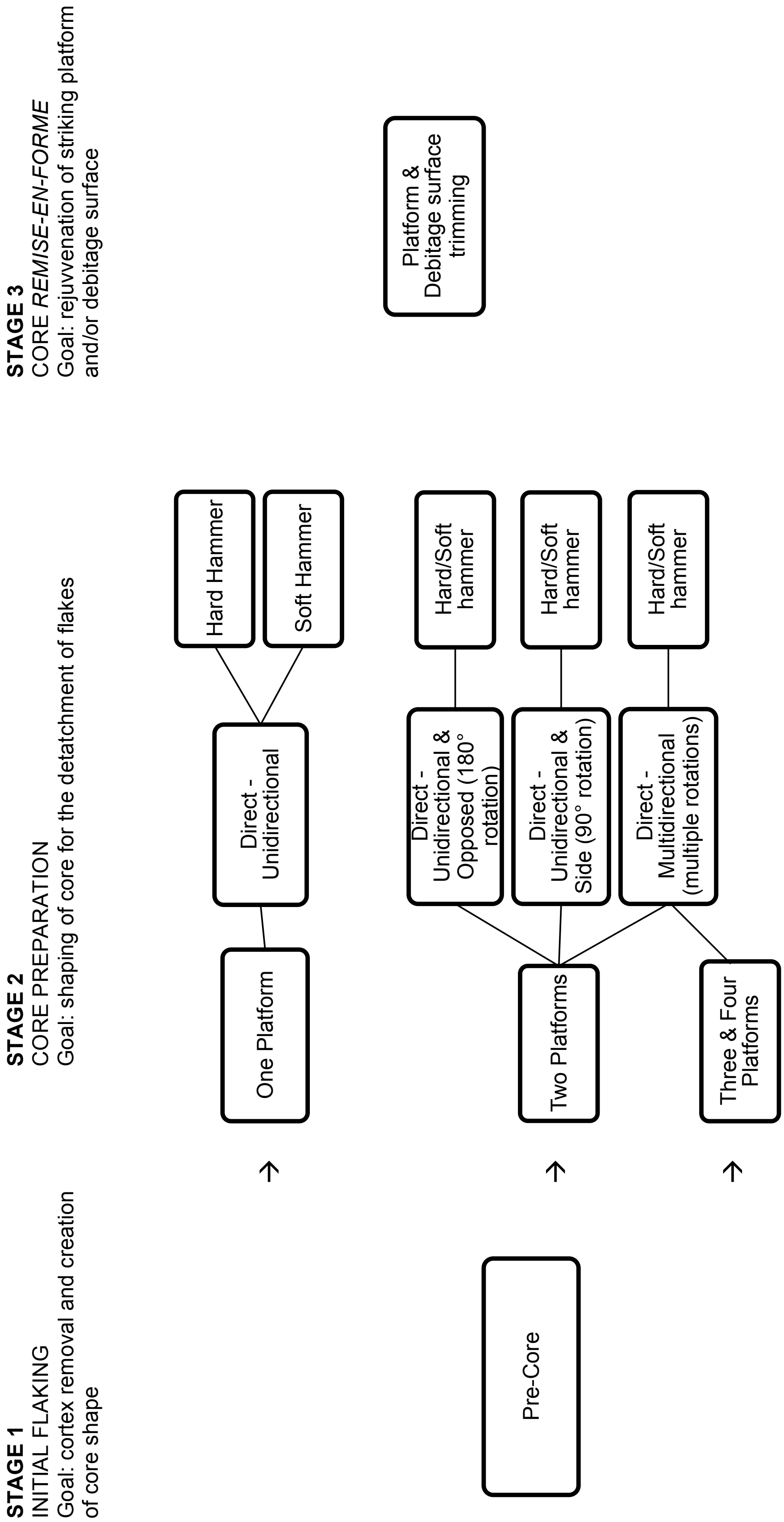


Fig. 8.7. Schematic representation of flake core *chaînes opératoires* at Rocca di Rivoli

These considerations open up, once again, the question of who the knappers at Rocca di Rivoli were. In Chapter 7 it was asked whether flint knapping was a task open to all or exclusive to few. Could anyone knap or was knapping the domain of few experts and their apprentices? On the basis of the different *chaînes opératoires* identified so far, I argue here that expert and non-expert coexisted. *Ad hoc* and opportunistic knapping was taking place alongside specialised manufacture of beautiful blades and pressure-flaked laurel leaves. Cores carefully prepared are found together with examples of irretrievably compromised ones, marked by mistakes that were mainly due to gross miscalculation in either blow intensity or direction or both. It is also likely that the same community might have shared *chaînes opératoires*, i.e. a blade core no longer in use might have been picked up by somebody who needed to knap a few flakes quickly in order to have of a cutting edge.

The presence of apprentices seems to be confirmed by the type of mistakes recurring throughout the two phases. In addition to the cores discussed above, debitage with repeated step scars also indicates the presence of non-experts/apprentices. Along with the apprentices there were also more expert knappers who were in the position to recover mistakes and communicate strategies to adopt in order to become a successful knapper (see above, Fig. 8.6).
In general, and on the basis of the data analysed so far, knapping strategies remained very similar during the two phases. There are, however, some important shifts in knapping style, which might indicate the development of a new tradition. First, the shift towards the production of flakes, followed by a blurred separation, at least from the point of view of knapping techniques, between the production of blades and flakes. This is evident in the preparation of core platforms as well as in the morphology of butts. Although blades continued to be of good quality and blade cores display a higher technological investment, it is also true that flakes were also objects of elaborate techniques in terms of platform preparation. With Rivoli Castelnuovo II, pressure flaking, already rare during Rivoli Castelnuovo I, went out of fashion, reinforcing the argument that blades lost their importance in favour of the flakes selected for the production of bifacially retouched artefacts. One wonders whether this shift includes a symbolic aspect, since it would seem that the aesthetic values begin to change with Rivoli Castelnuovo II (see Chapter 9).

Finally, I argue that changes in styles and tradition necessitated higher investment in sharing of knowledge, discussion and interaction among community members. It may have been a delicate and important moment, during which previous values were discussed and new ones affirmed. Regardless of the way in which changes in knapping strategies were introduced at Rocca di Rivoli during Rivoli Castelnuovo II, I think the presence of young apprentices would have provided an audience to speak about new ways to go about knapping: including new rules on raw material procurement, different knapping goals, and new ways of achieving them.

CHAPTER 9

FROM BLANK SELECTION TO ARTEFACT DISCARD

Retouching as a technological practice

The main aim of this chapter is to explore retouching as a technological practice. Bernardino Bagolini compiled a typological list of the retouched artefacts unearthed at Rocca di Rivoli according to Laplace's (1964) typological system and drew a sample of them for the excavation publication (Barfield & Bagolini 1976). Chapter 3 summarized the typological classification of retouched artefacts from the 1976 publication in Table 3.2. In Chapters 1 and 2 I pointed out the shortcomings of the adoption of Laplace's 1964 method and it is not my intention to re-discuss the retouched assemblage from Rocca di Rivoli in terms of its typological attributes and classification.

I strongly believe that in addition to a technological approach, use-wear analysis is necessary to undertake any typological *grand plan*. A macroscopic approach is no longer sufficient when discussing artefact use and function, which is at the heart of typological seriation, site interpretation and the definition of past cultural identities. No microscopic approach was undertaken for the present work, and I therefore resisted the temptation of creating a new typology based on the technological data produced through analysis of the Rocca di Rivoli assemblage. The risk of embarking on such an undertaking, although certainly a stimulating endeavour, is that it would remain an isolated exercise *per se*. For this reason, I decided to look at retouching from the point of view of technological choice: the blank chosen (blade or flake or blade-like-flake?), where the retouch was carried out (upper/lower face, distal/proximal end, both faces?), how the retouch was executed (regular/irregular) and which techniques were used to modify the artefact edge(s) (thermal flaking, burin blow).

By considering retouching as a technological practice, I also intend to keep it separate from its association with use and function. In the absence of use-wear analysis, it is not possible to determine the function(s) a retouched artefact was put to. Two points follow from this: the first is to reiterate that the concept of tool, as already discussed in Chapters 2 and 4, is no longer equivalent to that of retouched artefact, i.e. retouch is not indicative of use or a specific function, while non-retouched artefacts were often effectively employed as tools. The second has to do with the difficulty of identifying intentional versus spontaneous retouch with confidence. The former is the result of a precise decision taken by the knapper to modify the artefact's shape with a template in mind. The latter takes place through use. Some archaeologists argue that, upon macroscopic observation, non-regular removals often indicate the presence of spontaneous retouch through use. However, once again, in the absence of a microscope, this distinction remains a mere guess and was not explored here. Retouch was described as observed with the naked eye and often with the help of a magnifying glass. Naturally, this decision has interpretative consequences that will be discussed later on.

With the hope of linking Laplace's types to the results emerging here, Table 9.1 proposes a possible correlation between basic normative tool typologies (including Laplace's terminology 1964) and the terminology of the attribute-based classification used for Rocca di Rivoli assemblage dataset.

Rocca di Rivoli retouched artefact descriptive attributes					*Most common normative tool types*
Position	**Localization**	**Delineation**	**Morphology/Extension**	**Angle**	
Upper, lower, alternating, alternate, bifacial	Distal, proximal, lateral	Rectilinear, convex, concave, shoulder, irregular	Scaled, stepped, parallel, subparallel. Extension: short to invasive.	Abrupt, semiabrupt, low	*End- , side-, convergent scrapers*
Upper, lower, alternating, alternate	Distal, proximal	Point, tongue	Stepped, parallel, subparallel, crossed. Extension: short to long.	Abrupt, semiabrupt	*Awls, drills, borers/piercers, points*
Upper, alternate	Distal, proximal, lateral, mesial	Rectilinear, cran, convex, irregular, point	Stepped, parallel, subparallel, crossed. Extension: short to long.	Abrupt, semiabrupt	*Backed blades, truncations*
Upper, lower, alternating, alternate, crossed, bifacial	Distal, proximal, lateral	Rectilinear, cran, convex, irregular	Scaled, stepped, parallel, subparallel. Extension: short to covering.	Abrupt, semiabrupt, low	*Knives*
Upper, lower	Distal, proximal, lateral, mesial	Concave, irregular, notched, denticulated	Scaled, stepped, parallel, subparallel. Extension: short to long.	Abrupt, semiabrupt	*Notches and denticulates*
Burins					*Burins*
Upper, lower, alternating, alternate	Distal, proximal, lateral	Irregular, convex, rectilinear	Stepped, subparallel. Extension: short to invasive.	Abrupt, semiabrupt	*Strike-a-light, fabricators, outils sur blocs*
Bifacial	Distal, proximal, lateral, covering upper and/or lower	Point, tang and all of the above	Scaled, stepped, parallel, subparallel. Extension: short to covering.	Abrupt, low	*Arrow-heads, leaf points, hafted pieces, ovates, knives*

Table 9.1. Rocca di Rivoli retouched artefact descriptive attributes and main equivalent normative tool types.

Tables 6.18 to 6.28 and Figures 6.14 to 6.24 in Chapter 6 presented the general characteristics of the retouched artefact assemblage. Here it is worth emphasizing that a total of 1156 retouched artefacts were recorded. Of these, 667 (57%) were complete, of which 555 (395 flakes and 160 blades) come from Rivoli Castelnuovo I deposits, and 112 (81 flakes and 31 blades) come from Rivoli Castelnuovo II deposits. Once again, the size difference between the two samples is an important one and this should be taken into consideration when drawing inferences from the results of the analysis.

Blank selection

Retouching starts with the selection of a suitable debitage piece. Not all debitage pieces are subsequently retouched, although they might be used without further modification. Table 9.2 compares debitage and retouched artefacts from the two occupational phases. The majority of debitage from the Rivoli Castelnuovo I phase belongs to the blade-like-flake category (49.3%), whereas its retouched assemblage shows flakes as the most numerous (31.2%). The Rivoli Castelnuovo II assemblage goes exactly the opposite direction: flakes are the most common debitage category (32.3%), but blade-like-flakes (31.3%), although only slightly more common in percentage terms when compared to flakes (30.4%), are most numerous when it comes to the retouched artefacts assemblage.

It is also worth pointing out the absence of retouched microblades (already rare in the Rivoli Castelnuovo I phase) and the decrease of bladelets in the Rivoli Castelnuovo II phase. Also, a higher incidence (of approximately 5 percentage points) of retouched blade-like-flakes in the Rivoli Castelnuovo II phase is noticeable. There are slight variations among the other categories, but these are of minor significance especially when considering the small number of Rivoli Castelnuovo II retouched artefacts in comparison with those found in Rivoli Castelnuovo I contexts.

Debitage categories	**Rivoli Castelnuovo I**		**Rivoli Castelnuovo II**	
	Debitage	**Retouched**	**Debitage**	**Retouched**
> 6	0.2%	0.4%		
≤ 6 > 3	3.4%	6.8%	3.2%	5.4%
≤ 3 > 2	13.2%	20.9%	15.8%	21.4%
≤ 2 > 1.50	49.3%	25.6%	21.6%	31.3%
≤ 1.5 > 1	18.7%	31.2%	32.3%	30.4%
≤ 1 > 0.75	10.7%	10.8%	17.2%	8.9%
≤ 0.75 ≥ 0.50	4.4%	4.3%	8.9%	2.7%
< 0.50	0.1%		0.9%	
Total	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Table 9.2. Comparison between debitage and retouched artefacts from the two different archaeological phases according to Bagolini's (1968) categories (numerical quantities, complete artefacts only).

Tables 9.3 and 9.4 together with Figures 9.1 and 9.2 show the relationship between raw material type and Bagolini's (1968) artefact categories. Patterns for both phases mirror those displayed by the debitage (Figs. 7.14 and 7.15 in Chapter 7), confirming that Maiolica and Scaglia Variegata lithotypes remain the preferred raw material for blank selection throughout the two phases. Raw material such as Scaglia Rossa and Eocene, already rarely used during the Rivoli Castelnuovo I phase disappear almost completely during the Rivoli Castelnuovo II phase.

Retouched artefact categories	**Non Identifiable**	**Oolitico di San Vigilio**	**Scaglia Rossa**	**Scaglia Variegata**	**Maiolica**	**Rosso Ammonitico**	**Eocene**	**Total**
Micro-blade			1		1			*2*
Bladelet	2			9	27			*38*
Blade	6		7	22	73	1	7	*116*
Blade-like-flake	4		10	28	91		9	*142*
Flake	10	1	11	31	117		3	*173*
Large flake	2		3	15	40			*60*
Very large flake			2	4	18			*24*
Macro-flake								
Total	*24*	*1*	*34*	*109*	*367*	*1*	*19*	*555*

Table 9.3. Raw material types and Bagolini's (1968) artefact categories. Complete retouched artefacts from Rivoli Castelnuovo I deposits.

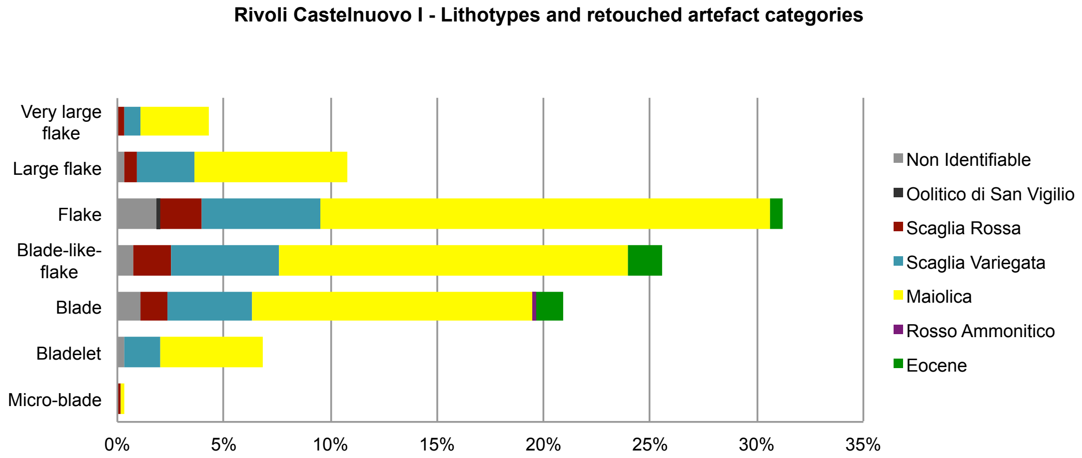


Fig. 9.1. Raw material types and Bagolini's (1968) artefact categories. Complete retouched artefacts from Rivoli Castelnuovo I deposits, percentage values.

Debitage categories	Non Identifiable	Oolitico di San Vigilio	Scaglia Rossa	Scaglia Variegata	Maiolica	Rosso Ammonitico	Eocene	Total
Bladelet	1			2	3			*6*
Blade	1		1	4	18			*24*
Blade-like-flake	4		1	10	20			*35*
Flake				8	25		1	*34*
Large flake	1			2	7			*10*
Very large flake	1			1	1			*3*
Total	*8*		*2*	*27*	*74*		*1*	*112*

Table 9.4. Raw material types and Bagolini's (1968) artefact categories. Complete retouched artefacts from Rivoli Castelnuovo II deposits.

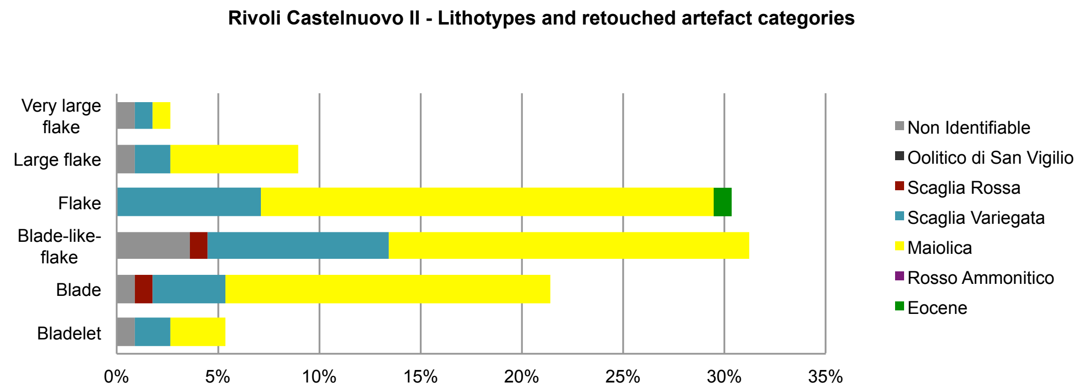


Fig. 9.2. Raw material types and Bagolini's (1968) artefact categories. Complete retouched artefacts from Rivoli Castelnuovo II deposits, percentage values.

Tables 9.5 and 9.6 provide an idea of the types of blanks chosen by the knappers at Rocca di Rivoli in terms of the stage at which a debitage piece was selected for retouching. The majority of blanks were attributed to the generic stage of core reduction (RC I: 50.3%, RC II: 36.6%), after core preparation and before any measure taken to rejuvenate the debitage surface. During Rivoli Castelnuovo I, blanks were also selected from the debitage resulting from episodes of core rejuvenation (17.1%) especially for retouched blades (3.8%), blade-like-flakes (4.9%) and flakes (5.2%). Pieces with cortex coming from the phase of core preparation were also occasionally picked (8.8%), especially for retouched blade-like-flakes (2.9%) and flakes (2.9%), but far less for blades (1.4%).

Artefact categories	Micro-blade		Bladelet		Blade		Blade-like-flake		Flake		Large flake		Very large flake		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable			7	1.3%	17	3.1%	32	5.8%	24	4.3%	5	0.9%			*85*	*15.3%*
Core Preparation			2	0.4%	8	1.4%	16	2.9%	16	2.9%	6	1.1%	1	0.2%	*49*	*8.8%*
Core Reduction	1	0.2%	17	3.1%	64	11.5%	66	11.9%	89	16.0%	27	4.9%	15	2.7%	*279*	*50.3%*
Rejuvenation of Debitage Surface			5	0.9%	21	3.8%	26	4.7%	33	5.9%	9	1.6%	1	0.2%	*95*	*17.1%*
Bifacial Preparation							1	0.2%							*1*	*0.2%*
Retouch Flake					1	0.2%			1	0.2%	1	0.2%	1	0.2%	*4*	*0.7%*
Platform Trimming									3	0.5%	9	1.6%	6	1.1%	*18*	*3.2%*
Core Tablets					1	0.2%					1	0.2%			*2*	*0.4%*
Piéce Esquillée									5	0.9%	1	0.2%			*6*	*1.1%*
Burin Spall	1	0.2%	7	1.3%	4	0.7%					1	0.2%			*13*	*2.3%*
Other									1	0.2%					*1*	*0.2%*
Roughout							1	0.2%	1	0.2%					*2*	*0.4%*
Total	*2*	*0.4%*	*38*	*6.8%*	*116*	*20.9%*	*142*	*25.6%*	*173*	*31.2%*	*60*	*10.8%*	*24*	*4.3%*	*555*	*100.0%*

Table 9.5. Knapping stage categories and artefact categories (from Bagolini 1968). Rivoli Castelnuovo I, complete artefacts only.

Artefact categories	Bladelet		Blade		Blade-like-flake		Flake		Large flake		Very large flake		Total	
	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Non identifiable	1	0.9%	10	8.9%	14	12.5%	8	7.1%	2	1.8%	1	0.9%	*36*	*32.1%*
Core Preparation			1	0.9%	3	2.7%	4	3.6%	1	0.9%	1	0.9%	*10*	*8.9%*
Core Reduction	4	3.6%	9	8.0%	12	10.7%	11	9.8%	5	4.5%			*41*	*36.6%*
Rejuvenation of Debitage Surface			3	2.7%	5	4.5%	5	4.5%	1	0.9%			*14*	*12.5%*
Bifacial Preparation														
Retouch Flake							1	0.9%					*1*	*0.9%*
Platform Trimming							2	1.8%	1	0.9%	1	0.9%	*4*	*3.6%*
Core Tablets							1	0.9%					*1*	*0.9%*
Piéce Esquillée					1	0.9%	1	0.9%					*2*	*1.8%*
Burin Spall	1	0.9%	1	0.9%			1	0.9%					*3*	*2.7%*
Other														
Roughout														
Total	*6*	*1.1%*	*24*	*4.3%*	*35*	*31.3%*	*34*	*30.4%*	*10*	*1.8%*	*3*	*0.5%*	*112*	*100.0%*

Table 9.6. Knapping stage categories and artefact categories (from Bagolini 1968). Rivoli Castelnuovo II, complete artefacts only.

During the Rivoli Castelnuovo II phase, selection of blanks followed the same patterns that had emerged during the earlier phase, although with differences in percentages. Retouched artefacts shaped on debitage resulting from episodes of core rejuvenation make up 12.5% of the entire assemblage (blades, 2.7%); blade-like-flakes, 4.5% and flakes, 4.5%). Corticated pieces coming from the phase of core preparation were occasionally selected (8.9%) for retouched blade-like-flakes (2.7%) and flakes (3.6%).

For both Rivoli Castelnuovo I and II phases a relatively high percentage of retouched artefacts could not be attributed to a knapping stage category (15.3% and 32.1% respectively). This reflects the lack of specific traits associated with each precise stage in the *chaîne opératoire*, mostly due to the extent of retouching and therefore modification undergone by the artefact.

Rough-outs

The stage between blank selection and final shaping is difficult to identify when dealing with secondary deposition and when no refits are available. Definitions of a rough-out are also not very clear (Inizan *et al.* 1999: 154). For bifacially retouched artefacts, a rough-out is usually a still imperfect form given to the artefact. Bagolini did attribute a final stage status to a number of bifacially retouched artefacts which, however, in fact still look rough and crudely manufactured (e.g. Barfield & Bagolini 1976, fig. 78 no. 17 and fig. 90c no. 11). These are described in Italian as "*strumenti a ritocco sommario*" ("tools with rough retouch"), and are referred to in the literature as finished products and possibly as bifacial cores (after Visentini & Dal Santo in Visentini *et al.* 2005a: 183, note 94). At least two such tools were identified at Rocca di Rivoli (ID 2011 and ID 4383).

A total of 14 probable arrowhead and point pre-forms were also identified on the basis of the following characteristics:

1. Rough retouch on both faces, often invasive but rarely covering.
2. Larger and thicker than finished bifacially retouched artefacts.
3. Shape resembling finished bifacial products and evidence for a series of more precise removals through pressure flaking carried out by an expert knapper (e.g. to produce a fine bifacially retouched leaf point or arrowhead).

Further specific experimental work and a wider review of late Neolithic VBQ lithic assemblages are needed in order to fully understand the *chaînes opératoires* leading to the production of bifacially retouched *foliati* (ovals, arrowheads, knives). At the same time, it is important to emphasize that debitage products associated with the utilization of bifacial cores (bladelets) as proposed by Visentini and Dal Santo (in Visentini *et al*. 2005a: 183, note 94) are an extremely rare debitage type at Rocca di Rivoli, which in turns opens the bifacial core hypothesis to further consideration.

Retouch

Chapter 4 described and discussed the attributes employed in the analysis of retouched artefacts (Tables 4.34 to 4.41 and Figures 4.16 to 4.27). This section will concentrate on a number of attributes which proved meaningful for the research questions set out: position, regularity and localization.

Tables 9.7 and 9.8 present the position of retouch on blades and flakes coming from the two occupational phases.

Both phases are characterised by a preponderance of upper face retouch on both flakes and blades. Bearing in mind sample sizes, it is interesting to note that bifacial retouch increases in the later phase of Rivoli Castelnuovo II. The production of burins is a well established practice in both phases, although it would seem that these were preferably made on flakes during the earlier Rivoli Castelnuovo I phase, whereas during Rivoli Castelnuovo II phase, burins were mainly made on blades.

Retouch Position	**Rivoli Castelnuovo I**		**Rivoli Castelnuovo II**	
	Qty	**%**	**Qty**	**%**
Upper face	87	54.4%	14	45.2%
Lower face	24	15.0%	2	6.5%
Alternating	1	0.6%		
Alternate	9	5.6%	1	3.2%
Crossed	2	1.3%		
Bifacial	13	8.1%	8	25.8%
Burins	12	7.5%	4	12.9%
Microburins	4	2.5%		
Burin spalls (retouched)	8	5.0%	2	6.5%
Total	*160*	*100.0%*	*31*	*100.0%*

Table 9.7. Position of retouching on complete blades from the two occupational phases (complete artefacts only).

Retouch Position	**Rivoli Castelnuovo I**		**Rivoli Castelnuovo II**	
	Qty	**%**	**Qty**	**%**
Upper face	207	52.4%	42	51.9%
Lower face	53	13.4%	4	4.9%
Alternating	3	0.8%	1	1.2%
Alternate	23	5.8%	2	2.5%
Crossed	2	0.5%	1	1.2%
Bifacial	37	9.4%	19	23.5%
Burins	53	13.4%	9	11.1%
Microburins				
Burin spalls (retouched)	7	1.8%	3	3.7%
Other special techniques	1	0.3%		
Not recorded	9	2.3%		
Total	*395*	*100.0%*	*81*	*100.0%*

Table 9.8. Position of retouching on complete flakes from the two occupational phases (complete artefacts only).

Tables 9.9 to 9.12 summarize retouch position in more detail in relation to different artefact categories (after Bagolini 1968). Upper retouch occurs more frequently on retouched flakes (18.20%), blade-like-flakes (13.15%) and blades (10.99%) from Rivoli Castelnuovo I contexts. In contrast blade-like-flakes (18.75%), followed at some distance by flakes (13.39%) and blades (9.82%), were the preferred blanks to be retouched on their dorsal surfaces during the Rivoli Castelnuovo II occupational phase.

Lower face retouch appears less important during the Rivoli Castelnuovo II phase. Alternating, alternate and crossed retouch types remain sporadic throughout the entire occupation. Interesting patterns are shown by bifacial retouch and by the burin category.

Artefact Type	Upper Retouch	Lower Retouch	Alternating	Alternate	Crossed	Bifacial	Burins	Other	Total
Micro-blade	1							1	*2*
Bladelet	16	8			1	5	1	7	*38*
Blade	61	16	1	10		8	11	9	*116*
Blade-like-Flake	73	14	1	8	2	20	19	5	*142*
Flake	101	22	2	11	1	13	21	2	*173*
Large flake	27	14		3		4	10	2	*60*
Very large flake	15	3					3	3	*24*
Macro-flake									
Total	*294*	*77*	*4*	*32*	*4*	*50*	*65*	*29*	*555*

Table 9.9. Retouch position on Bagolini (1968) artefact categories from Rivoli Castelnuovo I (numerical quantities, complete artefacts only).

Artefact Type	Upper Retouch	Lower Retouch	Alternating	Alternate	Crossed	Bifacial	Burins	Other	Total
Micro-blade	0.18%							0.18%	*0.36%*
Bladelet	2.88%	1.44%			0.18%	0.90%	0.18%	1.26%	*6.85%*
Blade	10.99%	2.88%	0.18%	1.80%		1.44%	1.98%	1.62%	*20.90%*
Blade-like-Flake	13.15%	2.52%	0.18%	1.44%	0.36%	3.60%	3.42%	0.90%	*25.59%*
Flake	18.20%	3.96%	0.36%	1.98%	0.18%	2.34%	3.78%	0.36%	*31.17%*
Large flake	4.86%	2.52%		0.54%		0.72%	1.80%	0.36%	*10.81%*
Very large flake	2.70%	0.54%					0.54%	0.54%	*4.32%*
Macro-flake									
Total	*52.97%*	*13.87%*	*0.72%*	*5.77%*	*0.72%*	*9.01%*	*11.71%*	*5.23%*	*100.00%*

Table. 9.10. Retouch position on Bagolini (1968) artefact categories from Rivoli Castelnuovo I (percentage value, complete artefacts only).

Artefact Type	Upper Retouch	Lower Retouch	Alternating	Alternate	Crossed	Bifacial	Burins	Other	Total
Micro-blade									
Bladelet	2					3	1		*6*
Blade	11	2		1		5	3	2	*24*
Blade-like-Flake	21	1	1		1	7	4		*35*
Flake	15	2		1		10	3	3	*34*
Large flake	5	1		1		1	2		*10*
Very large flake	2					1			*3*
Macro-flake									
Total	*56*	*6*	*1*	*3*	*1*	*27*	*13*	*5*	*112*

Table. 9.11. Retouch position on Bagolini (1968) artefact categories from Rivoli Castelnuovo II (numerical quantities, complete artefacts only).

Artefact Type	Upper Retouch	Lower Retouch	Alternating	Alternate	Crossed	Bifacial	Burins	Other	Total
Micro-blade									
Bladelet	1.79%					2.68%	0.89%		*5.36%*
Blade	9.82%	1.79%		0.89%		4.46%	2.68%	1.79%	*21.43%*
Blade-like-Flake	18.75%	0.89%	0.89%		0.89%	6.25%	3.57%		*31.25%*
Flake	13.39%	1.79%		0.89%		8.93%	2.68%	2.68%	*30.36%*
Large flake	4.46%	0.89%		0.89%		0.89%	1.79%		*8.93%*
Very large flake	1.79%					0.89%			*2.68%*
Macro-flake									
Total	*50.00%*	*5.36%*	*0.89%*	*2.68%*	*0.89%*	*24.11%*	*11.61%*	*4.46%*	*100.00%*

Table. 9.12. Retouch position on Bagolini (1968) artefact categories from Rivoli Castelnuovo II (percentage value, complete artefacts only).

Burin proportions remain pretty much constant throughout the two phases (RC I: 13.4% and RC II: 11.1%). Burins recorded as special techniques are primary ones, i.e. a given artefact displays one or two burin blows but not in association with other types of retouching on either faces or on any of the edges. The decision to keep primary burins distinct from sharpening burins was deliberate, intended to separate two possibly different knapping behaviours. Primary burins on unretouched debitage pieces represent a specific tool *per se*, and their burin facets were intended to create a sharp edge, while sharpening burins probably constituted part of the retouched artefact re-sharpening process once the original retouch became worn through use.

In some cases, a burin facet might closely resemble a breakage pattern caused during use, but only the use of a microscope might assist with an unambiguous identification. Re-sharpening burins will be further discussed in the next section.

Another attribute which was systematically recorded was regularity of retouch. This is different from a regular or irregular delineation (see Chapter 4, Fig. 4.18). Regularity measures the way the knapper took care to make the retouch look uniform, for instance by carefully removing retouch flakes of roughly the same size, with the same angle and extent. Tables 9.13 and 9.14 along with Figures 9.3 and 9.4 show point in the direction of a retouch which, according to the parameters set out, for the majority lacks regularity.

Retouch Position	**Blades**			**Flakes**		
	Regular	**Irregular**	**NA**	**Regular**	**Irregular**	**NA**
Upper face	18	67	2	24	176	7
Lower face	4	19	1	3	45	5
Alternating		1			3	
Alternate		8	1	4	18	1
Crossed		2		1	1	
Bifacial	4	7	2	5	26	6
Total	*26*	*104*	*6*	*37*	*269*	*19*

Table 9.13. Retouch regularity in relation to retouch position on artefacts coming from Rivoli Castelnuovo I deposits (burins, burin spalls and other special techniques are not included, complete artefacts only).

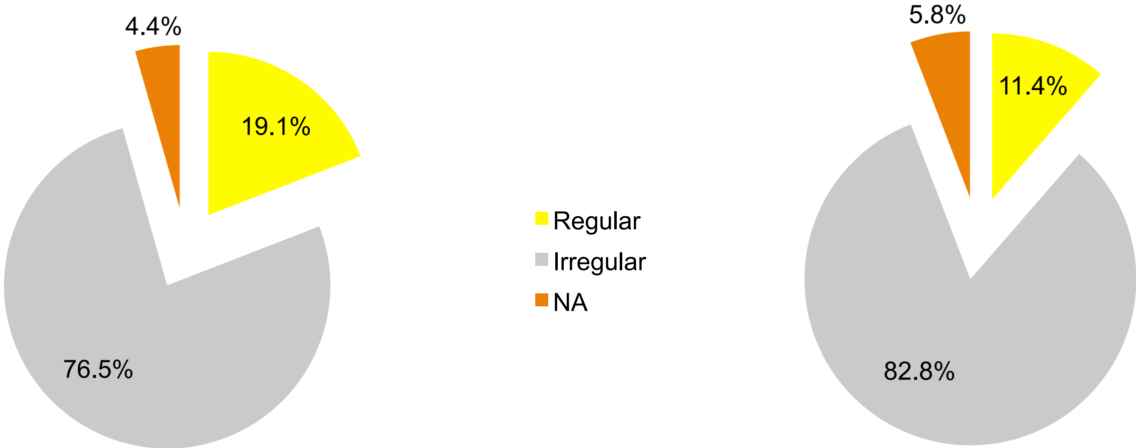


Fig. 9.3. Retouch regularity recorded on retouched artefacts from Rivoli Castelnuovo I deposits (burins, burin spalls and other special techniques are not included, complete artefacts only).

Retouch Position	**Blades**			**Flakes**		
	Regular	**Irregular**	**NA**	**Regular**	**Irregular**	**NA**
Upper face	3	8	3	1	36	5
Lower face		2			4	
Alternating					1	
Alternate		1			2	
Crossed					1	
Bifacial	1	6	1	2	16	1
Total	*4*	*17*	*4*	*3*	*60*	*6*

Table 9.14. Retouch regularity in relation to retouch position on artefacts coming from Rivoli Castelnuovo II deposits (burins, burin spalls and other special techniques are not included, complete artefacts only).

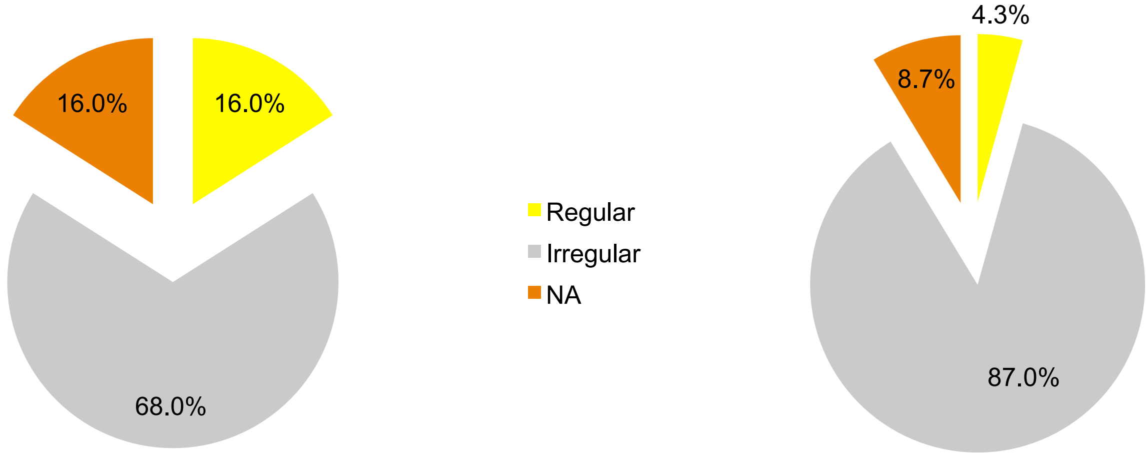


Fig. 9.4. Retouch regularity recorded on retouched artefacts from Rivoli Castelnuovo II deposits (burins, burin spalls and other special techniques are not included, complete artefacts only).

Different localization patterns emerged among the most common retouch types (position: upper, lower and bifacial), (Figs. 9.5 to 9.8). Blades from Rivoli Castelnuovo I display similar frequencies of lower retouch when compared to flakes from the same period (11% to 12%), whereas upper retouch is more frequent in blades (65% to 63%) and bifacial removals are found in higher quantity on flakes (22% to 19%). The most common retouch localization among Rivoli Castelnuovo I flakes with upper retouch is on the artefact distal end (26.8%). Most blades from the same period are also retouched on their distal ends (30%), although lateral retouch (left: 13%, right: 15%) follows closely. Lower retouch, although not very common, occurs primarily on distal ends and on lateral portions of both flakes and blades. Bifacial retouch is carried out on more portions of the artefact when compared to other types of retouch. Whereas the preferred retouch localization for flakes is to cover upper and lower faces (followed by lateral removals), for blades once again, lateral retouch is more frequent.

Blades from Rivoli Castelnuovo II contexts display lower frequencies of upper and lower retouch when compared with flakes from the same period (50.9% to 58.7% and 3.8% to 4.2% respectively), whereas bifacial retouch is found more commonly on blades (45.3% to 37.1%). The most common retouch localization among Rivoli Castelnuovo II flakes with upper retouch is on the artefact lateral edges (left: 11.9% and right: 14%), followed by removals located on the distal ends (23.8%). Blades from the same period are retouched on their upper faces, mostly on their lateral edges (24.5%), and distal ends (17%). Similarly to the patterns identified for Rivoli Castelnuovo I, lower retouch, although not very common, occurs primarily on distal ends and lateral portions on both flakes and blades, although there are a couple of isolated examples on flake proximal ends. Again, similarly to the previous occupational phase, bifacial retouch is carried out on more portions of the artefact when compared to other types of retouch. The preferred localization for flakes is lateral retouch (14%), followed by removals fully covering upper and lower faces (8.4%). Like blades, lateral retouch on flakes is more frequent (15%) than fully retouched upper and lower surfaces (10%).

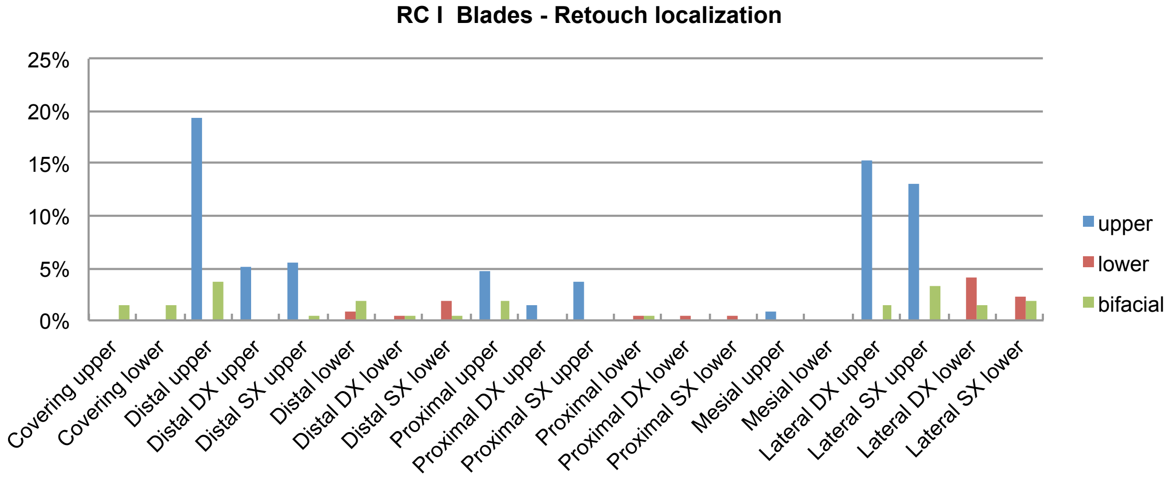


Fig. 9.5. Localisation of removals on blades with upper, lower and bifacial retouch. Rivoli Castelnuovo I, complete artefacts only.

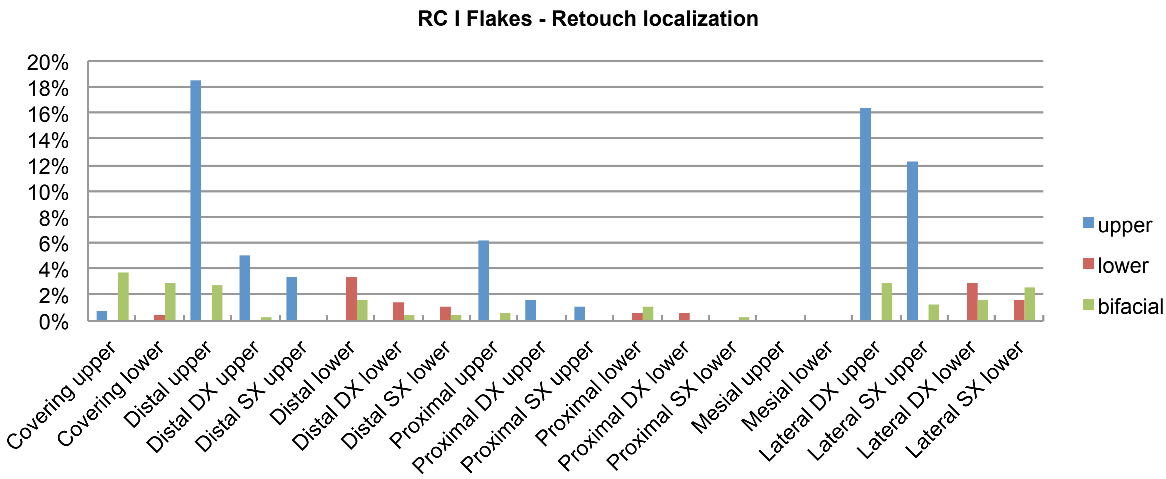


Fig. 9.6. Localisation of removals on flakes with upper, lower and bifacial retouch. Rivoli Castelnuovo I, complete artefacts only.

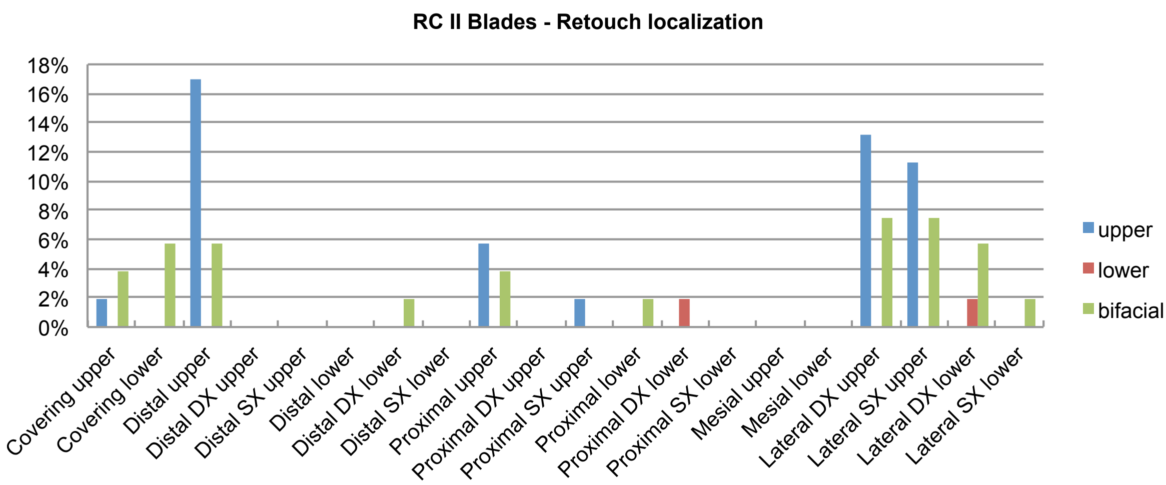


Fig. 9.7 Localisation of removals on blades with upper, lower and bifacial retouch. Rivoli Castelnuovo II, complete artefacts only.

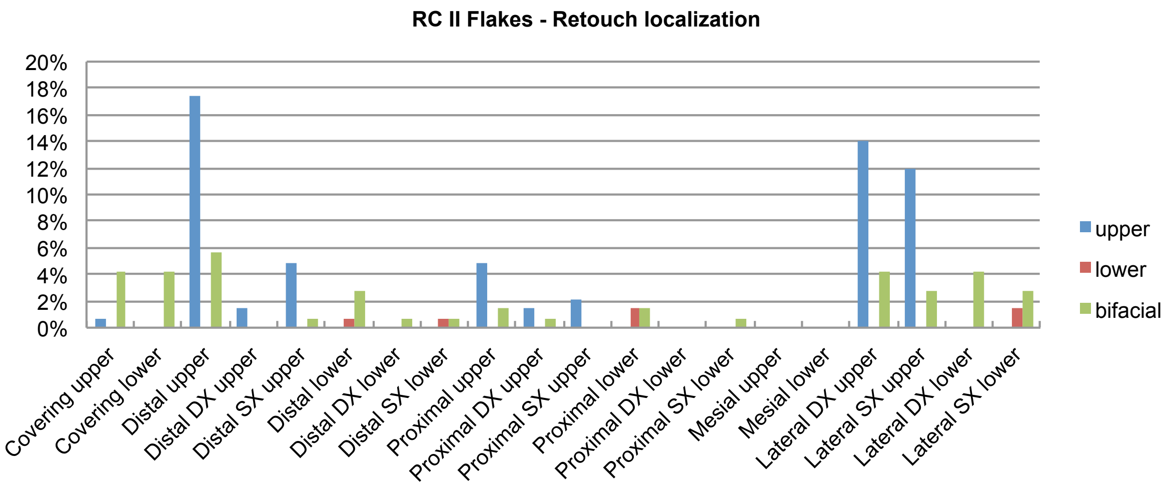


Fig. 9.8. Localization of removals on flakes with upper, lower and bifacial retouch. Rivoli Castelnuovo II, complete artefacts only.

Although upper retouch remains the preferred way to modify debitage at Rocca di Rivoli throughout both occupational phases, the frequency of bifacial retouching sees a steep increase from Rivoli Castelnuovo I to Rivoli Castelnuovo II: from 19.9% to 45.3% on blades, and from 22% to 37% on flakes.

Retouched artefacts maintenance and use

There is little information concerning the maintenance and use of retouched artefacts, that can be retrieved through macroscopic study. In addition to burins recorded as a special retouch technique, re-sharpening burins were identified along with re-sharpening burin spalls: 10 re-sharpening burins on retouched blades and 33 on flakes from Rivoli Castelnuovo I contexts, along with a total of 16 burin spalls; 9 re-sharpening burins on retouched flakes and 3 on blades, together with a total of 4 burin spalls from Rivoli Castelnuovo II contexts. Burin spalls are very rare, although recovery of this type of finds was probably affected by the lack of sieving during excavation since most burin spalls tend to be very small. Nonetheless, the practice of re-sharpening both retouched artefacts and burins did exist at Rocca di Rivoli throughout both occupational phases.

Conclusion: discussion of results

Data resulting from the analysis undertaken on the retouched artefacts coming from the two occupational phases complete the picture of knapping on the Rocca di Rivoli during the late Neolithic. The selection of blanks to be retouched took place at different times during the reduction process. The majority of retouched artefacts from both occupational phases was selected whilst core reduction was under way (RC I: 50% and RC II 36%), after the core was prepared and before any action aimed at rejuvenating its debitage surface was to take place. A smaller number of blanks made from debitage were produced during episodes of core rejuvenation (RC I: 17% and RC II: 12%) as well as core preparation (RC I and RC II: 8%). The latter were almost entirely corticated pieces or debitage with portions of the natural surface still on the dorsal surface. Nonetheless, they were considered suitable to be further shaped into a pre-determined form. A rather high percentage of retouched artefacts (RC I: 15% and RC II: 32%) could not be attributed a blank type, other than based on dimensions (e.g. blade, flake, microblade etc.). This is probably due to the increased presence of bifacially retouched artefacts during Rivoli Castelnuovo II phase. Bifacial retouch completely obliterated traces carrying information relating to the blank knapping stage.

Although knapping mistakes were recorded for retouched artefacts, these are not indicative of errors taking place during the retouching process. In fact, a plunged or hinged flake/blade or the presence of incipient cones on the butt are all mistakes that occurred during debitage production. It is interesting to note that the presence of mistakes occurring during core reduction did not prevent a debitage piece from being selected as a suitable blank for subsequent retouch. In fact, 21% of retouched blades and 16% of retouched flakes from Rivoli Castelnuovo I deposits displayed knapping mistakes on their dorsal faces, ends or butts. The mistake rate on selected blanks drops with Rivoli Castelnuovo II material: 11% and 6% for retouched flakes and blades respectively. At the same time, it should be noted that a higher percentage of bifacially retouched artefacts characterize the Rivoli Castelnuovo II phase and that errors which occurred during debitage knapping might have been obliterated by subsequent invasive retouch.

As far as at raw material types are concerned, retouched artefacts follow closely the rest of the assemblage from the site. The most common lithotypes are Maiolica and Scaglia Variegata. As with the debitage assemblage, flint types already rare in the Rivoli Castelnuovo I phase (e.g. Scaglia Rossa and Eocene) almost completely disappear during the Rivoli Castelnuovo II phase. The choice of these two raw material types agrees well with the increase of bifacially retouched artefacts in the later occupational phase. Scaglia Rossa and Eocene types, would not have been as suitable to be worked into thin artefacts characterised by bifacial pressure flaking taking place on both faces and the Rosso Ammonitico or Oolitico di San Vigilio flint types even less so.

The preferred way to modify a piece of debitage, be it a flake or a blade, into a pre-determined shape is through retouching its upper face, especially on the artefact distal end and along its lateral edges (Tables 9.7 and 9.8). Lower and bifacial retouch follow at some distance with the first being more frequent during the earlier occupation phase (RC I: 13% and RC II: 5%) and the second seeing an increase during the later phase (RC I: 9% and RC II: 23%).

Retouch for both phases appears in general irregular; i.e. removals are often of different sizes and depth. This characteristic has often been associated with so-called “spontaneous” retouch, taking place through use rather than as a pre-determined action with a precise goal. However, the high percentage of irregularly retouched pieces from both occupational phases at Rocca di

Rivoli (Tables 9.13 and 9.14 and Figures 9.3 and 9.4) suggests the idea of irregularity based on morphology of removals needs to be reviewed. It also calls for the lithic specialist to reconsider the criteria used to distinguish regular from irregular, and whether to make this distinction at all. If retouched edges appeared uniform and tidy thanks to the systematic detachment of roughly same-sized tiny removals during the early Neolithic, this practice was no longer meaningful towards the end of the Neolithic. At the same time, one should refrain from associating this trait to a loss of manual ability and design skill, or aesthetic sensibility. In fact, regular retouches do occur as well as special techniques which are the result of skilled craftsmanship as well as a marked aesthetic sensibility. For instance, IDs 1112 and 1308 from Rivoli Castelnuovo I and IDs 1452 and 1129 from Rivoli Castelnuonvo II represent some fine examples of bifacially retouched points with accurate pressure flaking on both faces.

Retouch morphology is but one way to gain an idea of the level of skill or the existence of a specific kind of craftsmanship for producing retouched artefacts. In Chapter 8 a series of core and debitage specific attributes were singled out in the attempt to gauge knappers' skill levels at Rocca di Rivoli (e.g. platform preparation in cores and elaborate butt types in debitage). This showed that a number of techniques usually associated with craft specialization in the literature (e.g. platform preparation), although still present and perfectly executed, occurred only rarely. In particular, it was pointed out that differences between the two occupational phases could be indicative of a gradual but decisive shift towards the consolidation of a tradition geared around the production of bifacially retouched lithic artefacts. It was also suggested that skilled knappers' efforts were redirected to this technique, and that teaching of novices would have been essential for consolidating and further developing the bifacial retouch method.

Data from the retouched assemblage supports this hypothesis: bifacially retouched artefacts increased during the later phase of Rivoli Castelnuovo II. This technique was rather different from more common upper or lower retouching techniques but not new to the VBQ knappers at Rocca di Rivoli. Bifacially retouched artefacts had characterised VBQ lithic assemblages from the late VBQ I period although it is difficult to obtain data regarding the percentage of this type of artefacts at assemblage level. The presence of apprentices is more difficult to discern at retouched artefact level.

Artefact discard

The last stage of a hypothetical *chaîne opératoire* is discard, when the lithic artefact is disposed of and enters the archaeological record. At Rocca di Rivoli, this last stage is represented by the interment of flint artefacts mostly in pits, together with other material culture (e.g. quern stones, animal bones, pottery fragments etc.) the perceived value of which was no longer associated with the dynamics of everyday use or on-going social interactions.

In Chapter 3 there was a brief discussion of current interpretative themes relating to pit digging and filling. The topic is far from exhausted, but the tendency, regardless of chronology and geography, is to view pits as potential symbolic repositories of meaningful objects and the action of pit digging as a social practice at times referencing specific beliefs or key values at community level (Chapman 2000; Garrow 2007; Pollard 2001; Thomas 1999: 64-74).

This section sets out to explore discard behaviour at Rocca di Rivoli in relation to the flint artefacts recovered from the Rivoli Castelnuovo I and II pit deposits. Tables 6.1 and 6.3 in Chapter 6 summarize the distribution of the main types of finds among the pits selected for the present study. In addition, Bernardino Bagolini analysed and presented the retouched artefact assemblage together with cores from of each pit in the excavation publication (Barfield & Bagolini 1976: 75-126). Here attention will be given to the analysis of those attributes which were selected in order to throw light on reasons for discard or abandonment of the different classes of artefacts.

Reasons for discard

Different reasons can lead to take the decision to discard an artefact, such as an irretrievable mistake during artefact knapping or use, exhaustion through wear, breakage, faults in raw material, and change in perceived value. Unfortunately, not all of the reasons just outlined can be identified confidently through macroscopic examination and often several reasons might have prompted the decision to finally dispose of the artefact.

Table 9.15 compares reasons for discard recorded from cores belonging to the two occupational phases. As already pointed out in Chapter 7, the majority of cores coming from Rocca di Rivoli, regardless of the occupational phase they belong to, appear rather worn and exhausted, suggesting that raw material, once brought to the site was exploited as much as possible. There are, of course, exceptions and different degrees of exploitation, but the main reason for a core to be given up is its exhaustion or the presence of irretrievable mistakes, such as platform crushing or repeated steps on the debitage surface, preventing the detachment of additional debitage.

Reasons for core abandonment	**Rivoli Castelnuovo I**		**Rivoli Castelnuovo II**		**Total**	
	Qty	**%**	**Qty**	**%**	**Qty**	**%**
Non identifiable	11	5.9%	2	1.1%	*13*	*7.0%*
Dimensions	59	31.9%	9	4.9%	*68*	*36.8%*
Faulty raw material	20	10.8%	1	0.5%	*21*	*11.4%*
Repeated steps on debitage surface	23	12.4%	2	1.1%	*25*	*13.5%*
Fatal mistake (step, otrepassée)	17	9.2%	1	0.5%	*18*	*9.7%*
Angle	22	11.9%	4	2.2%	*26*	*14.1%*
Crushing of striking platform	11	5.9%	3	1.6%	*14*	*7.6%*
Other						
Total	*163*	88.1%	*22*	11.9%	*185*	100.0%

Table 9.15. Main reasons for discard of cores from the two occupational phases at Rocca di Rivoli.

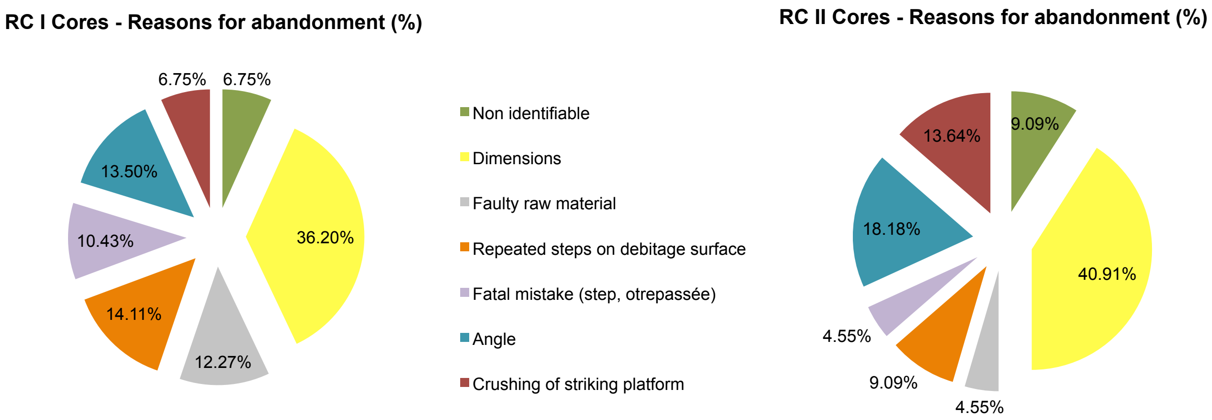


Fig. 9.9. Main reasons for core discard, comparison between RC I and RC II cores (% values).

Figure 9.10 together with Table 8.32 in Chapter 8 evaluate knapping mistakes as possible reasons leading to debitage discard. In Chapter 8 it was also observed that some so-called knapping "accidents" are at times used as specific strategies in order to obtain a certain desired end product. For instance, plunged blades might be effectively used for blade cores *re-mise en forme.* It was also noted previously that some retouched artefacts were shaped out of faulty debitage (with mistakes such as a hinge or a lipped bulb) as if mistakes did not always matter when further retouching debitage pieces.

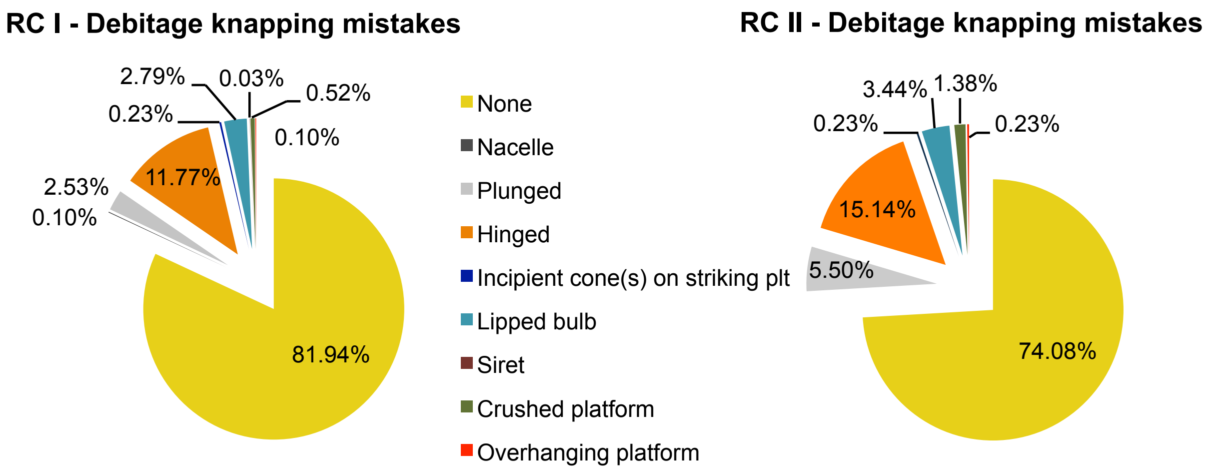


Fig. 9.10. Knapping mistakes recorded on debitage from Rivoli Castelnuovo I and II deposits (% values).

It is interesting to note that debitage with hinged terminations, crushed platforms or incipient cones on butts increase in the later phase of Rivoli Castelnuovo II. These errors are typical of knappers with little or no experience, negotiating raw material constraints and manual dexterity.

No specific attribute was singled out in order to try to understand the reasons behind their abandonment of retouched artefacts. Mistakes present were recorded, but as specified earlier, these refer to errors taking place during knapping. Breakage and wear are possibly two major reasons to throw away a retouched artefact. Unfortunately, whether these were caused by post-depositional phenomena or were brought about by Neolithic users cannot be determined without the use of a microscope. Tables 9.16 and 9.17 summarize fragmentation data for debitage and retouched artefacts respectively.

Debitage fragmentation	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total	
	Qty	%	Qty	%	Qty	%
Complete	3084	73.0%	436	63.6%	*3520*	*71.7%*
Distal	430	10.2%	73	10.7%	*503*	*10.2%*
Proximal	424	10.0%	119	17.4%	*543*	*11.1%*
Fragment	289	6.8%	57	8.3%	*346*	*7.0%*
Total	*4227*	*100.0%*	*685*	*100.0%*	*4912*	*100.0%*

Table 9.16. Debitage fragmentation at Rocca di Rivoli.

Retouched artefact fragmentation	Rivoli Castelnuovo I		Rivoli Castelnuovo II		Total	
	Qty	%	Qty	%	Qty	%
Complete	555	61.1%	112	45.7%	*667*	*57.8%*
Distal	112	12.3%	36	14.7%	*148*	*12.8%*
Proximal	75	8.3%	23	9.4%	*98*	*8.5%*
Fragment	166	18.3%	74	30.2%	*240*	*20.8%*
Total	*908*	100.0%	*245*	100.0%	*1153*	*100.0%*

Table 9.17. Retouched artefact fragmentation at Rocca di Rivoli.

When comparing the two assemblages (debitage/retouched) it is immediately noticeable that the retouched artefact assemblages from both occupational phases display a higher fragmentation rate than unretouched debitage (Retouched RC I: 38% and RC II: 42%; Debitage RC I: 27% and RC II: 36%), and that fragments show dramatically higher percentage values when comparing retouched and unretouched artefacts. This latter aspect is especially noticeable when looking at fragments of retouched artefacts coming from Rivoli Castelnuovo II deposits: 30.2% compared to 8.3% of debitage fragments from the same phase or 18.3% of retouched fragments belong to the earlier Rivoli Castelnuovo I phase.

Many of the discarded flint artefacts, with the exception of cores (mostly exhausted or impossible to keep using) and debris, are complete, which makes one question why they ended up in a pit in the first place. The aid of use-wear analysis could surely throw some light on wear patterns, although it is rather difficult to think of all discarded objects as worn out through use. In the next section, pit digging and filling as a practice will be discussed, and although there is no certain answer to the question above, the relationship between human beings and flint at Rocca di Rivoli will be further explored through attitudes to disposal of flint artefacts.

The practice of pit digging and filling at Rocca di Rivoli

Lithic artefacts went to fill the pits dug on the Rocca together with fragments of pottery, quern stones, clay artefacts, polished axes, animal bones and other organic remains (Barfield & Bagolini 1976: 5-16). Flint knapping was but one of a variety of community activities taking place at the site. It is difficult to estimate the duration or frequentation of the Rocca during the Rivoli

Castelnuovo I and II phases. According to the stratigraphic data available, at least four episodes of pit filling could be identified (see Chaper 3). At the same time, with the exception of 7 pits (V and W; P, Q and R, D and G), the filling of which was considered part of one single episode, no other data was available to suggest meaningful temporal relationships between pits.

Pit digging and subsequent filling with debris from everyday activities was a common practice at Italian Neolithic sites and throughout Europe (e.g. Cavulli 2008: 332-334; Pearce 2008, Bernabò Brea *et al.* 2010). Only recently however, have archaeologists working on the Italian Neolithic (ibid.) started to pay attention to artefact associations that might suggest structured deposition (*sensu* Richards & Thomas 1984: 205). The data available from Rocca di Rivoli unfortunately is extremely limited in this respect and no striking depositional associations were mentioned by the excavators (Barfield & Bagolini 1976: 5-16). Any reasoning related to structured deposition was far from being considered, in particular in Italian prehistory, towards the end of the 1970s when the 1963-68 excavations were published. At the same time, although it would be unwise to put too much emphasis on the scanty details provided by the publication, there are elements in the description of the pit fills that are good candidates for arguing structured deposition at the site (Richards & Thomas 1984), such as a group of arguably non-domestic or special finds:

- fragments of a clay figurine (Barfield & Bagolini 1976: 65);
- 4 fragmented clay cylinders in pit L in addition to at least 4 quern stones (ibid.: 64);
- the upper part of a figurine in pit D (ibid.);
- the base of a figurine, a *pintadera* fragment (ibid.: 64);

The clay figurine in pit W was found together with carbonized acorns (ibid.: 13), whereas the clay cylinders from pit L were deposited together with 4 quern stones (ibid.: 137). The base of the figurine and *pintadera* fragment were found together with 2 quern stones in pit V (ibid.). Quern stones of quartz porphyry were recorded in the fills of pits N, P, S, U, Z and R (ibid.).

Together with the finds, it is interesting to note that episodes of pit digging and subsequent filling varied. A group of pits (J, K, S, V, W, Y) displays the presence of side slips, pointing at the fact that after having dug them, these pits were left open for some time prior to be filled with soil, organic and non organic material. From the stratigraphy it is not always clear how many episodes of pit filling took place to fill a given pit, however, with the exclusion of pits K, M, N, T, all the other pits saw a minimum of two distinct layers, probably reflecting two separate filling episodes.

Despite the lack of precise details, the records from Rocca di Rivoli hint to the presence at the site, as at other Neolithic sites in Italy (Pearce 2008; Bernabò Brea & Mazzieri 2010) and across Europe (e.g. Chapman 2000c; Garrow 2007), of structured and repetitive activities associated with ritual behaviour (Thomas 1984: 191-192). For some of the pits, their filling was delayed (side slip) and interspaced to receive different remains at different times. Additional stratigraphical data as well as information regarding the deposition of other types of finds (e.g. animal bones) are needed in order to complete the picture of pit filling at Rocca di Rivoli. For the time being it is clear that disposal of material culture remains on the Rocca followed rules and that some of the pits may well have been filled during specific episodes in association with ritual practices.

Similarly to other VBQ sites characterised by the presence of pits (e.g. Lugo di Grezzana, Razza di Campegine, Vho-Campo Ceresole) it can be argued that the disposal of settlement debris and, among these, flint artefacts, referenced specific events, meaningful to the community enacting them. More data however would be needed from Rocca di Rivoli in order to explore this hypothesis further.

Chapter 10

CONCLUSIONS

A number of key sites of the Italian Neolithic (such as Quinzano, Arene Candide and Fimon) were excavated many years ago and, like Rocca di Rivoli, pose a series of challenges for archaeologists wanting to re-analyse existing excavation records in order to answer new research questions. The present study faced some of those challenges. Firstly, the loss of contextual information due to poor conservation (e.g. handling of paper bags) or accidents (flooding of the museum premises) which considerably reduced the sample of flint artefacts suitable for analysis.

Another challenge was posed by the intrinsic nature of the archaeological record at Rocca di Rivoli. Preservation of settlement structures was partly adversely affected by taphonomy, disturbance by Bronze Age and Medieval occupation, quarry activity and earlier site investigation by Pellegrini (1875). This limits any understanding of relationships among structures as well as to redeposition of finds affecting the artefact sample (especially Neolithic and Bronze Age floors). Moreover, the only well preserved artefacts suitable for study came exclusively from secondary depositional contexts (pits), which in turn allow for the reconstruction of only fragmented *chaînes opératoires* and the impossibility of defining potential activity areas. Finally, problematic access to the museum during the data recording phase also meant that certain research methods could not be employed (see Chapter 3).

Nonetheless, analysis undertaken as part of the present study of the flint assemblage from Rocca di Rivoli has produced some significant results which help to enhance our understanding of several aspects of the late Neolithic lithic technologies at the site. These include:

1. Raw material procurement and its organization (discussed in Chapter 7);
2. Knapping technology in terms of core preparation, debitage and retouched artefacts production (discussed in Chapter 8);
3. Organization of lithic production among different members of the community and identification of expert, non-expert and novice knappers (discussed in Chapters 7, 8, 9 and further in this chapter);
4. Identification of possible styles and traditions as part of the diachronic development of lithic technologies between the two occupational phases of Rivoli Castelnuovo I and II (Chapters 8 and 9).

The present research has also reviewed and evaluated concepts and definitions employed in lithic studies in Italian prehistory and more widely, on the basis of the case study of Rocca di

Rivoli, such as ‘resources control’, ‘skill’ and ‘craft specialization’. In particular, attention has focussed on knapping strategies, including the different retouching modes as technological practices rather than the outcome of functional attributes. The next section will sum up the conclusions of the present work in the context of current research into the late Neolithic of northern Italy and European late prehistoric lithic studies in general.

Raw material procurement

Throughout this thesis it was repeatedly pointed out that Rocca di Rivoli is located in a privileged location for raw material procurement. Although no flint outcrops are to be found on the Rocca itself, it is situated right in the middle between the Lessini Mountains to the east and Mount Baldo to the west: two inexhaustible and accessible sources of good- to excellent-quality flint.

Chapter 5 discussed the issues concerning flint type attribution, in terms of lithotype identification, outcrop type and raw material provenance. For the time being it is not possible to attribute the raw material origin of a specific artefact to a precise outcrop in the landscape (Cremaschi 1981). Both macroscopic and microscopic approaches can identify the lithotype and the rock formation it belongs to (with varying degrees of confidence depending on different circumstances) and in some cases can tentatively suggest the nature of the parent material (i.e. when sufficient cortex is still available on the artefact). Although this affects how far the relationship between Rocca di Rivoli knappers and the surrounding landscape can be explored in relation to choice of, and access to, the available flint, results from raw material procurement analysis provided some interesting insights which were discussed at length in Chapter 7 and are considered in the wider VBQ context below.

Rocca di Rivoli knappers preferred flint of the Maiolica variety, and as second best that from the Scaglia Variegata formations. Other lithotypes were also present, but in very small quantities, during the first occupational phase of Rivoli Castelnuovo I, but these disappeared almost completely during the later Rivoli Castelnuovo II phase. It was argued in Chapter 7 that these preferences were most probably due to the fact that Maiolica and Scaglia Variegata are far superior quality-wise when compared to the other flint types. In addition, better quality flint would have performed better in particular for the production of bifacial, flatly retouched artefacts which see a sharp increase during the Rivoli Castelnuovo II phase.

Denial of access to some of the sources previously exploited, it was argued, was unlikely. Firstly, lithotypes such as Scaglia Rossa and Oolitico di San Vigilio are readily available from secondary deposits such as the river bed and glacio-fluvial deposits in the immediate surroundings of Rocca di Rivoli (between 1 and 3km). It is difficult to imagine controlled access of the river bed and of streams or gorges in the surrounding hilly area. Secondly, Rocca di Rivoli has been interpreted as a key production site from which flint would leave to reach communities further afield (Barfield 1999, 2000; Barfield & Bagolini 1976). It is likely that it was the community based on the Rocca that exercised control of flint production and exchange in the immediate vicinity of the site (and perhaps even farther afield).

A number of authors have argued that VBQ communities controlled access to Alpine flint resources in the area comprising the Lessini Mountains and Mount Baldo (the so-called 'Venetian platform') (e.g. Mottes 2002, Barfield 2000, Dal Santo & Visentini 2005: 181). This interpretation is supported by the conspicuous presence of Alpine flint from this area at VBQ sites situated far from the Alpine flint sources. For instance, at Bannia-Palazzine di Sopra (Pordenone, Friuli Venezia Giulia), Alpine flint represents 90% of the entire assemblage despite local flint being readily available and of good quality (Dal Santo & Visentini 2005: 181). Circulation of flint was certainly a way to maintain and control cultural identity and unify communities dislocated across a vast territory (ibid.). Dal Santo and Visentini take their argument further by suggesting that circulation of knowledge concerning flint outcrops as well as access to other resources *loci* in the landscape was in the "public domain" for members of the VBQ cultural group (2005: 184). This is supported by the lack of specialisation in terms of knapping technology, which is common to a number of VBQIII sites. This point is going to be further discussed in the next section. However, for the time being, it is important to observe that the site of Rivoli might represent an exception to this pattern as specialisation is evident at this production site where flint artefacts were made not only for local consumption but also to be exchanged with far-flung communities.

At the raw material procurement level, specialisation is apparent in the way that the quality of the raw blocks of flint was evidently assessed before being brought to the site to be knapped. In Chapter 7 it was suggested that procurement took place in different ways, depending on who was setting off and whether it was as part of another activity (such as herding, hunting or water fetching, etc.) or the main goal of the day ahead (e.g. expert knapper setting off to obtain a particular type of flint to be knapped into a fine grave good). It is clear from Table 9.15 that only approximately 10% of Rivoli Castelnuovo I cores and 11% of Rivoli Castelnuovo II cores were discarded because of faulty raw material. This indicates that sharing of knowledge was an important part of raw material procurement and that most rocks brought up to the Rocca were of good quality. It is argued here that outcrop recognition and the ability to assess flint quality are to be regarded as specialist capabilities which imply both familiarity with the surrounding landscape, and deep knowledge of the flint characteristics to look out for during raw material selection. Regardless of who procured the raw material for knapping on the Rocca, and how it was procured, it would seem that they were knowledgeable about what was needed.

Technological practice and craft specialization

Whether craft specialisation was present at Rocca di Rivoli during the late Neolithic was another key question posited at the start of the research. The existence of craft specialists in the manufacture of flint products is a trait usually associated with social hierarchy, which may be evident at some VBQ funerary sites during phase II (middle Neolithic) (Pessina & Tiné 2008: 295-306). Arnold (1984: 37) proposed a number of diagnostic indicators to identify specialist behaviour and to distinguish it from non-specialist manufacturing of stone tools:

1. High relative and absolute volume of artefact production;
2. A certain kind and degree of standardization in tool production methods;
3. Repeated, intensive use of well-defined activity areas (craft workshops) within a site or sites;
4. Evidence for some degree of control over critical raw material resources;
5. Presence of specialists' paraphernalia within certain burials.

As regards the first indicator, Rocca di Rivoli can be considered a site with a high volume of artefact production. Unfortunately it is extremely difficult to obtain even approximate information about finds quantities retrieved from other archaeological VBQ sites in northern Italy. The site of Lugo di Grezzana, further east in the Lessini Mountains and interpreted as an early Neolithic flint blade workshop, produced approximately 40,000 finds (pottery and flint together) (Pedrotti & Salzani 2010). If the quantities from Lugo di Grezzana can be held to be a "high relative and absolute volume of artefact production" (Arnold 1984: 37), Rocca di Rivoli also conforms to this picture (see estimated quantification of total flint finds in Chapter 3).

Standardization, which is defined here as the consistent repeated implementation of technical and technological guidelines in prehistoric tool production, can be measured in two ways at Rocca di Rivoli. The first is in terms of evidence for a standardized reduction process, in the way that cores are reduced according to a series of defined steps which imply the application of the same knapping techniques and reduction strategies to obtain a final product, the characteristics of which are defined *a priori*. This is recognisable at debitage level, with certain types of debitage occurring over and over again. In certain cases it might also be recognisable on cores, such as when a number of cores entered the archaeological record at a precise stage of reduction, showing precise choices being made in terms of knapping strategy. The second way is to measure standardization by focussing on retouched artefacts. Observation of the type of blanks, dimensions, retouch mode combined with use-wear analysis can potentially disclose information on whether further shaping through retouching of debitage material was to match pre-determined templates through the adoption of a series of precise knapping techniques.

This type of data would provide information about the existence of community-wide goals and tacit or explicit agreement concerning precise instructions on how to achieve them. It would likely be subject to a certain degree of organization of production or at least co-ordination. Unfortunately, there are not enough data available at the moment from Rocca di Rivoli to determine such standardization. As mentioned in Chapter 8, *chaînes opératoires* resulting from the analysis of the artefacts coming from the two occupational phases are fragmented, and although certain types of artefacts do recur over and over again it was not possible to attribute them to a specific *chaîne opératoire* for the production of a specific artefact (e.g. a bifacially retouched arrowhead). The general picture at Rocca di Rivoli is one where recurrent trends are detectable but standardization is not. At the same time, this might have been affected by the nature of the archaeological record and the way data were interrogated. It is possible that other types of analysis might lead to a different interpretation.

The repeated use of well-defined activity areas unfortunately cannot be assessed at Rocca di Rivoli. Preservation of settlement structures was poor and as already mentioned, the flint sample analysed came from secondary deposition contexts, which would be inappropriate to use to infer activity areas. Bagolini (Barfield & Bagolini 1976: 121) mentioned differences in the composition of the assemblages coming from the pits. He indicated this might have been related to different activity areas (ibid). However, given the nature of the deposits that accumulated in the pits, and recent interpretations of pit digging and filling practices (see Chapter 9), it might be more appropriate to consider pit fills in the context of site clearance rituals associated to particular events such as rites of passage, inter-community gatherings and exchange.

While no activity areas can be identified at the site, the site itself can be considered a well-defined production and exchange centre within the VBQIII settlement network. In addition to the high volume of flint artefacts recovered, its geographical position makes it well situated to act as an exchange landmark. Rocca di Rivoli is not only situated at the heart of a flint-rich area, in a dominant and easily defensible position, but it is also well connected via the Adige river valley to the northern Alpine mountains and to the southern plains. Remains of pottery from southern Germany as well as from the Po plain, confirm the site's role as a meeting and exchange point on a well-known routeway (Barfield & Bagolini 1976).

The evidence for control over resources in the landscape was anticipated above when raw material procurement was discussed. Archaeologists working on the VBQ period agree about a certain degree of control over flint resources on behalf of the different VBQ communities (Pessina & Tiné 2008; Dal Santo & Visentini 2005; Mottes 2002). At the same time, details of how this would have been organized are yet to be formulated, and the data obtained from the analysis undertaken on the Rocca di Rivoli assemblage do not help to resolve this question.

Finally, the presence of specialists' paraphernalia is difficult to assess. No burials were unearthed at Rocca di Rivoli or in its immediate vicinity. Flint artefacts recur often occur as grave goods starting from the VBQII phase (Pessina & Tiné 2008: 296). Archaeologists working on recently discovered sites in Emilia (e.g. via Guidorossi, Le Mose; Bernabò Brea *et al.* 2014) described long flint blades and arrowheads (along with polished stone artefacts) as characterising male burials. These finds were interpreted in relation to lineage or inhumation rituals but have not yet been linked to flintknapping specialization. For the time being, the equivalent of the 'flintknapper' from Hazelton North (Saville 1990) is yet to be excavated. At the same time, the production of long blades found in burial contexts has been interpreted elsewhere as evidence of craft specialization (e.g. Bulgarian Chalcolithic: Gurova 2006; Sardinian Neolithic and Calcolithic: Guilbeau 2012; French Calcolithic: Vaquer *et al.* 2012). Although no information is yet available on the blades found in the VBQ burials in Emilia, it is possible that these were produced by specialised craftsmen.

Overall, craft specialization cannot be confidently argued for at Rocca di Rivoli. There are, however, aspects that point towards the development of specialist flint knapping at the site. In Chapters 8 and 9, it was pointed out that the record from Rocca di Rivoli indicates the coexistence of expert with less expert knappers, with carefully executed elaborate artefacts found together with poorly retouched flakes or artefacts displaying beginners' mistakes. A question which emerged from the effort to record and measure skill through artefact attributes was: "at what stage does an expert knapper become a specialised craftsmen?" Arnold (1984) points out that the existence of community members specialised in one or more tasks means that their subsistence-directed activity is significantly reduced and other members of society must take care of that aspect for them. This is not always a necessary condition, however, and is dependant upon the type of societal organisation, size and so forth (ibid). Secondly, craft specialisation presupposes performance of a task that it is not accomplished with the same rate of success by a non-specialist. Specialists have access to information, materials, skills, experience, ritual paraphernalia and/or rights exclusive to practitioners of the craft. Finally, specialisation implies production beyond one own's needs, whether at community or extra-community level. With the exception of the first, the other two indicators were confirmed by results obtained through the analyses undertaken as part of the present work. At the same time, more data are needed, fully to understand the status of expert flintknappers at Rocca di Rivoli. A possible hint might reside in the production of those long blades which feature so prominently in the VBQII burials in Emilia. These are made with Alpine flint and although data regarding how they arrived at the sites are not yet available, their area of origin was located in the Lessini Mountains.

On the basis of the lithic evidence collected so far, Rocca di Rivoli presents a transitional situation. Knapping was carried out by expert knappers with highly developed skills alongside non-expert knappers. Raw material procurement was well organized and took place in different ways. It is possible that members of the community were fetching flint, regardless of their knapping expertise, clearly knowledgeable about the landscape and the mechanics of a good piece of flint. Apprentices were probably present, contributing to the variety of knapping strategies and mistakes identified at the site. The extent to which the expert knappers were specialised craftsmen remains uncertain for the time being: perhaps they were in the process of negotiating their status, or maybe finding themselves in a territory so rich in flint they were not too fussy about who was knapping what and which raw materials they were using. Relationships with members of different communities (VBQ or other) probably partly relied on the capacity of the Rocca group to produce aesthetically pleasing and symbolically meaningful long blades, rough-outs ready to be shaped into bifacial arrowheads, or just well prepared cores for sharp flakes to be taken off miles away from the original source.

Re-analysis of the lithic finds from Rocca di Rivoli undertaken for the present thesis, contributes in three different ways to the present state of research in different disciplines. As regards lithic studies, the present endeavour, confirms once again that the *chaîne opératoire* approach is most suitable and works well with material coming from secondary deposition. In fact, although fragmented and incomplete, the 16 reduction sequences identified at Rocca di Rivoli, provide significant insights on knapping styles and technological choices which can be considered representative of the late Neolithic tradition in northern Italy, such as the predominance of flakes over blades obtained through the exploitation of one platform cores or the intense exploitation of the raw material, resulting in very small residual cores.

When looking at the available literature on the Italian late Neolithic and the contribution that lithic studies can supply in order to better understand the period, I believe the present work offers an alternative theoretical approach including social agency and social-anthropological perspectives that, although not fully blown in the interpretation of the results, have shaped the analysis and discussion of the data collected. Manipulation of the latter throughout the thesis, I believe, has the merit to be readily accessible in the form of tables and graphs used to generate interpretations and support arguments that strive to bring out the social dimension in prehistory, i.e. moving away from functional interpretations and the focus on the artefacts *per se*.

Finally, the present work shows the potential of old collections and their role in further advancing the discipline. The lithic artefacts from Rocca di Rivoli posited a number of research challenges that I feel prompted the re-examination of the evidence at the site but also the re-discussion of broad concepts and precise terminology that are often taken on board *a priori* and end up falling short when trying to make sense of the evidence available. In particular, the re-discussion of concepts such as craft specialization, style, expediency and curation, to name only a few, I feel, were in need when interpreting the late Neolithic lithic evidence of northern Italy.

Future research

The great amount of data recorded for the flint assemblage from Rocca di Rivoli was only partially interrogated. The database built for the present research (and included in the Appendix) provides information on at least 21 technological attributes for each artefact (with the exclusion of debris). This offers a great many possibilities to explore flint knapping further at Rocca di Rivoli. The adoption of a social-anthropological approach meant that I concentrated on aspects of late Neolithic flintknapping which, although they appear in recent publications, are rarely tied to quantifiable data. Indeed, one often is left wondering on which basis some interpretations in the wider literature are built. I hope that the tables and charts provided throughout this thesis have been useful not only to support my arguments, but also to make available data more readily understandable and the interpretation process as transparent as possible.

There are two promising avenues for future research that I would like to pursue. The first is to investigate further the presence of apprentices at Rocca di Rivoli and the related mechanisms through which knowledge was shared and passed on from the expert to the future expert. I only briefly touched on this, but the data already available are potentially very interesting, and it should be possible to compare these with evidence from other sites in Europe or and from modern day replication activities with young adults and children. The second to consider further is aesthetics and symbolism. In this case, the evidence is scanty but an increasing rich and stimulating literature is available (e.g. Coote & Shelton 1992; Gosden 2001; Stahl 2013) to inspire alternative ways to interrogate datasets like those from Rocca di Rivoli.

APPENDICES

Appendix 1

C14 DATES FROM ROCCA DI RIVOLI

Two different sets of radiocarbon dates are available for Rocca di Rivoli (Table 1 below). The first set (Birm-103 and Birm-104, Shotton et al. 1970: 397) was discarded since dates contradicted stratigraphic records (Barfield & Bagolini 1976: 140). Sample Birm-103, collected from the earlier deposits of pit L attributed to Rivoli Chiozza phase turned out to be later in date than the sample Birm-104 taken from pit Z attributed to the later Rivoli Rocca phase (which was to be renamed “Rivoli-Castelnuovo” phase; Barfield & Bagolini 1976: 20, n.2) (see Table A1 below).

A second set of C14 dates (Birm-617 and Birm-616; Williams & Johnson 1976: 266) was taken from Rivoli-Castelnuovo II deposits at the intersection of pits P, Q and R. These deposits represent the latest stage of Neolithic occupation at Rocca di Rivoli (Barfield & Bagolini 1976: 140) and provided two dates fitting in with pottery stylistic development at the site and in line with dates coming from coeval sites in Italy and north of the Alps which are related to this phase at Rivoli by imports (ibid.). These two determinations, however, are also problematic. They appear to have been taken from bulk samples from the same context, but their calibrations hardly overlap (see Fig. A1 below).

From the first set of dates provided it is clear that pit L deposits had probably been affected by re-deposition caused by subsequent pit-digging taking place at the site. As a matter of fact the earliest deposits of pit L are the only ones providing a pottery style which was stylistically interpreted as “developing out of the Quinzano phase” (Barfield & Bagolini 1976: 140). However these early conclusions were based on pottery styles and on the fact that the continuity in style from Quinzano to Rivoli-Chiozza appeared to be greater than between Rivoli Chiozza and Rivoli Castelnuovo pottery types (Barfield & Bagolini 1976: 140). Although this initial interpretation has not been revised since, it appears weak in the light of the scanty remains available for this phase.

Visentini and co-workers (Visetini et al. 2004) in their revision of Neolithic radiocarbon dates for northern Italy, did not include the dates from Rocca di Rivoli, holding them “unreliable” and “coming from a context not clearly defined” (ibid.). It is not clear which dates Visentini is referring to, i.e. if the first set or the second set or both. Surely the first set, as it has been outlined above and as pointed out by Barfield & Bagolini (1976: 140) is certainly so. One of the dates belonging to the second set is noticeably providing a too high standard deviation, according to Visentini (ibid.). As a matter of fact, C14 dates for Rivoli, in the same way of numerous dates produced in the 1970s or before then, are now seen to be scarcely reliable (Skeates & Whitehouse 1994: 149).

Re-calibration of all dates from Rocca di Rivoli was undertaken for this thesis using OxCal online program. Results are summarised in Table A1 and Fig. A1 and I second Visentini's impression on the lack of reliable calibrated dates for Rivoli (Visentini et al.: 2004).

In conclusion, the first set of dates is not to be held reliable for dating the site. The second set of dates fits in with the wider picture when comparing pottery styles within northern Italy and when referencing coeval cultures of which pottery fragments were unearthed in the Rivoli Castelnuovo pit deposits. It follows that Rocca di Rivoli can be almost certainly be attributed a Rivoli Castelnuovo I and II phases, as belonging to the second half of the 5th millennium BC, but any earlier attribution is discouraged at this point on the basis of the scanty material evidence attributed to a hypothetical first Rivoli Chiozza phase of occupation. On the basis of these conclusions, although Rivoli Chiozza lithic artefacts were included in this study at the recording stage, they were not included during analysis and subsequent interpretation of the results.

Sample code	Provenance	Phase	Material sampled	Uncalibrated date	2δ calibrated date
Birm-103	Pit L	Rivoli Chiozza	collagen fraction of bone (*Bos*)	5520±120	4650 - 4050
Birm-104	Pit Z	Rivoli Rocca	collagen fraction of mixed bone (mainly *Bos* and *Sus*)	5670±130	4830 - 4260
Birm-617	intersection pits P,Q,R	Rivoli Castelnuovo II	collagen from unidentified animal bones	5370±70	4350 - 4010
Birm-616	intersection pits P,Q,R	Rivoli Castelnuovo II	collagen from unidentified animal bones	5070±100	4150 - 3650

Tab. A1. Radiocarbon dates from Rocca di Rivoli, calibrated using OxCal 4.2 (Bronk Ramsey 2009), calibration curve IntCal2013 (Reimer et al. 2013).

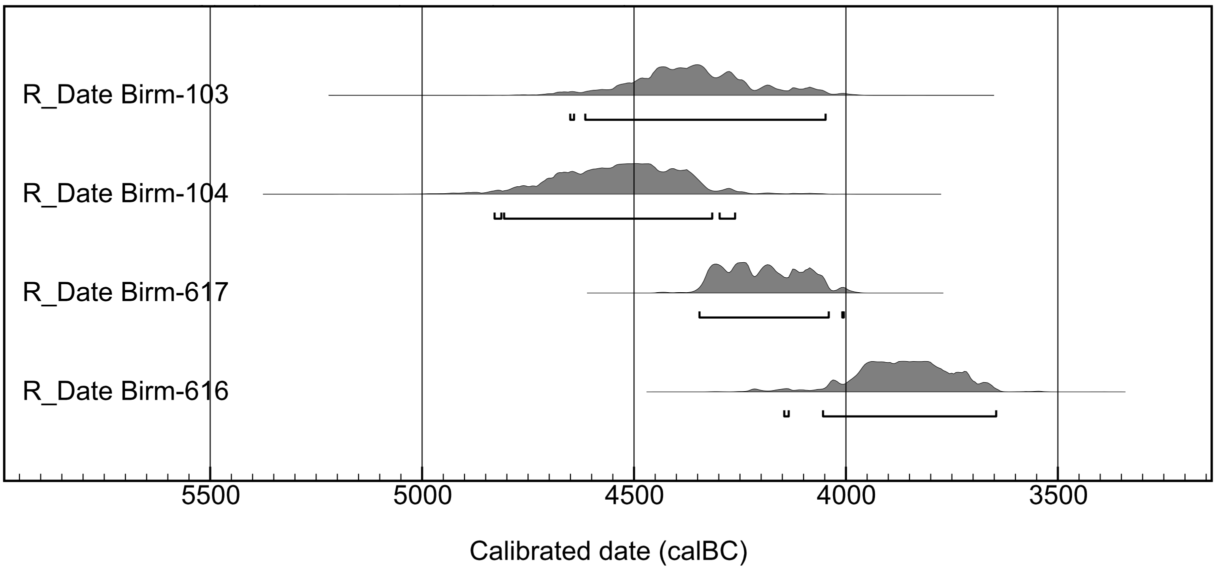
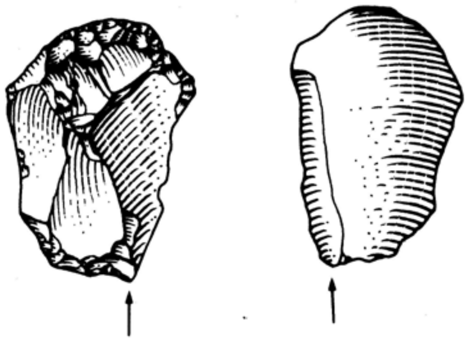


Fig. A1. Calibration curves for the four C14 dates from Rocca di Rivoli (source: OxCal https://c14.arch.ox.ac.uk/oxcal.html).

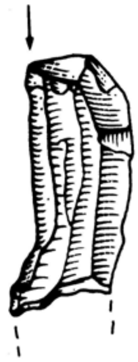
Appendix 2

PLATES



PIT D / ID 1117

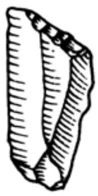
PIT D / ID 1126



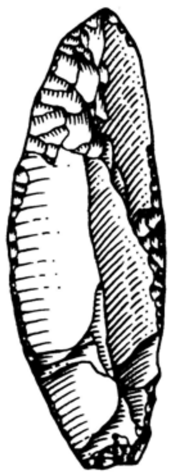
PIT D / ID 1127

PIT D / ID 1134

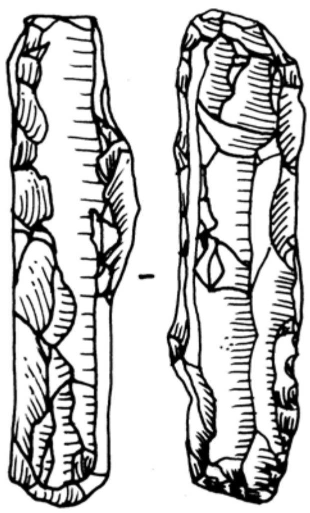
PIT D / ID 1129



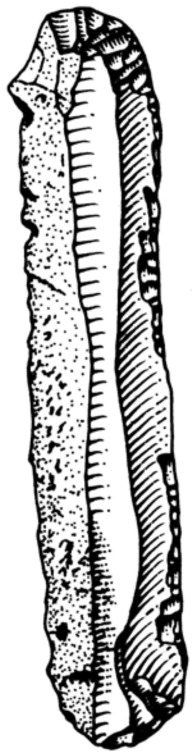
PIT D / ID 1128



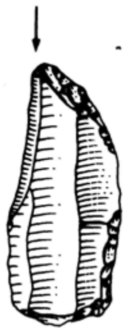
PIT D / ID 1130



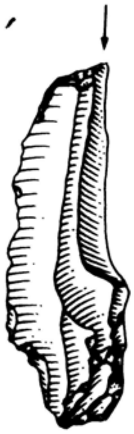
PIT D / ID 1135



PIT D / ID 1361

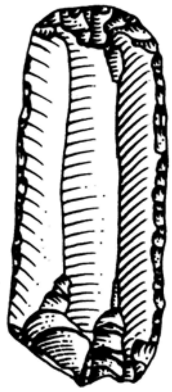


PIT G / ID 1132



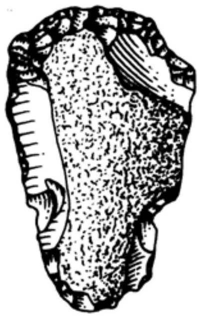
PIT G / ID 1133

PIT G / ID 1327



PIT G / ID 1176

PIT G / ID 1320

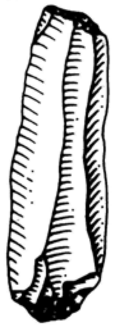


PIT G / ID 1334

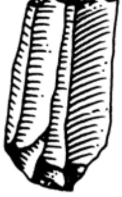
PIT G / ID 1175

PIT G / ID 1332

PIT G / ID 1323

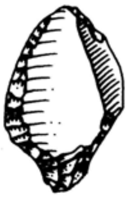


PIT G / ID 1324



PIT G / ID 1331

PIT G / ID 1177



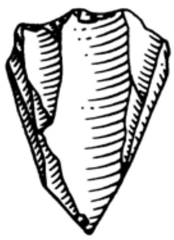
PIT G / ID 1158

PIT G / ID 1163

PIT G / ID 1318

PIT G / ID 1328

PIT G / ID 1181



PIT G / ID 4329

PIT G / ID 1315

PIT G / ID 1325

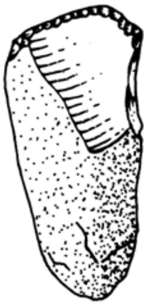
PIT G / ID 1170

PIT G / ID 1173

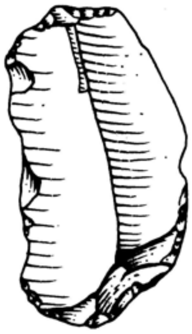
PIT G / ID 1156

PIT G / ID 1157

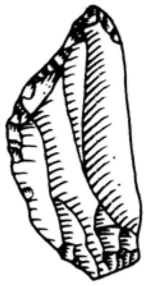
PIT G / ID 1159



PIT J / ID 1161



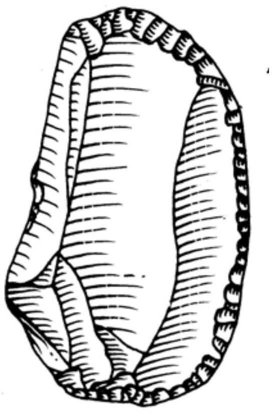
PIT J / ID 1171



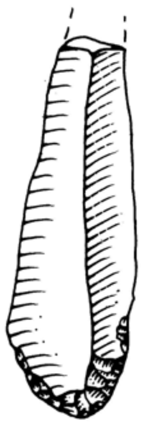
PIT J / ID 1160

PIT J / ID 4330

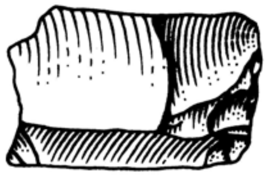
PIT J / ID 1118



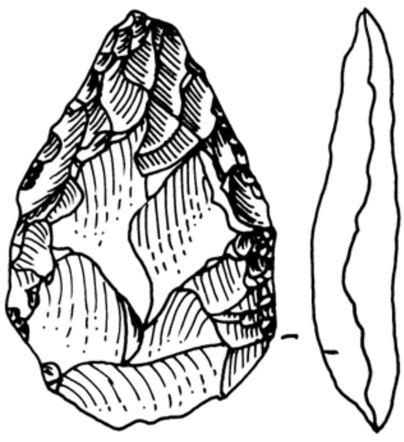
PIT J / ID 1115



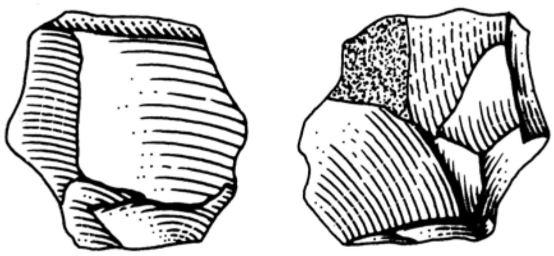
PIT J / ID 1114



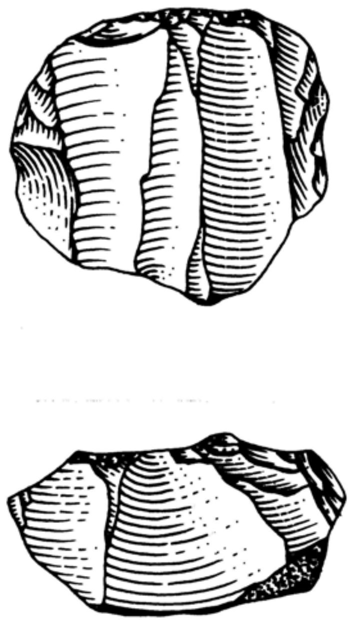
PIT J / ID 4457



PIT J / ID 1105

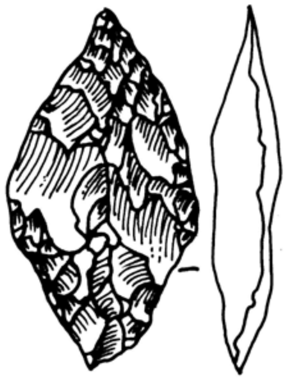


PIT J / ID 4326



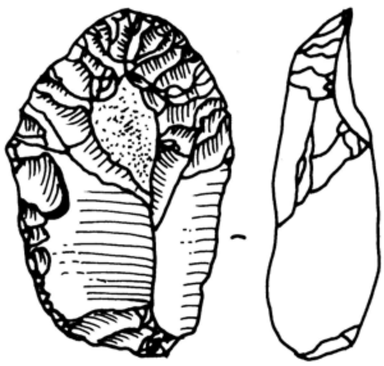
PIT J / ID 4328

PIT K / ID 1141

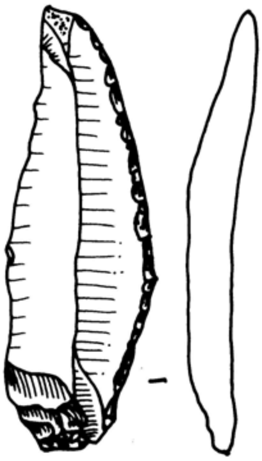


PIT K / ID 1154

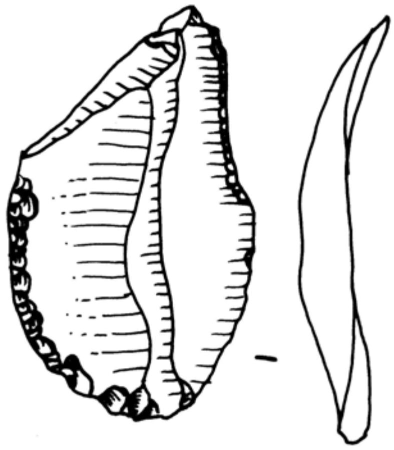
PIT K / ID 1155



PIT K / ID 1140

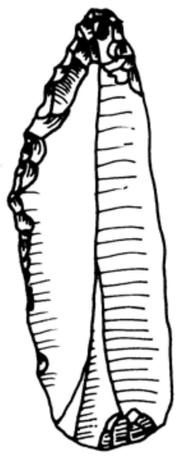


PIT M / ID 1102

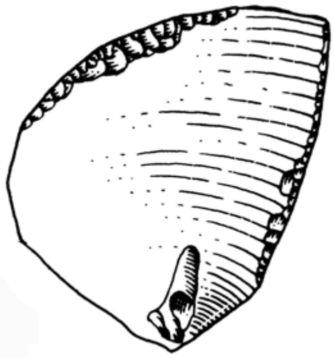


PIT M / ID 1103

PIT N / ID 1147

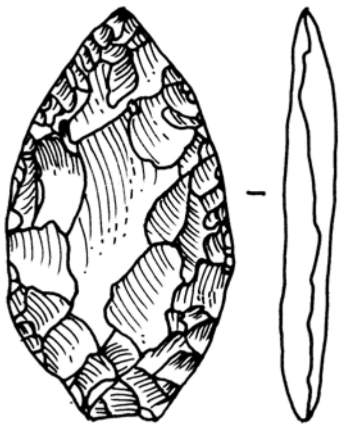


PIT N / ID 1151



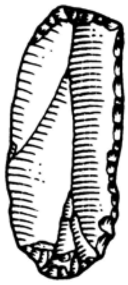
PIT N / ID 1136

PIT N / ID 1137



PIT N / ID 1148

PIT O / ID 1162

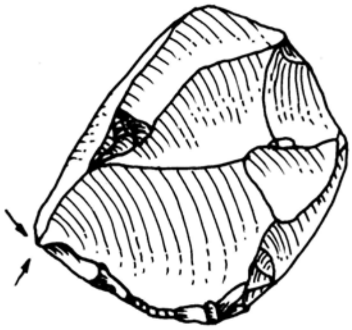


PIT O / ID 1235

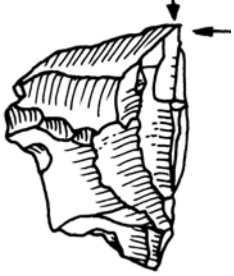
PIT O / ID 1345

PIT O / ID 1336

PIT O / ID 1143

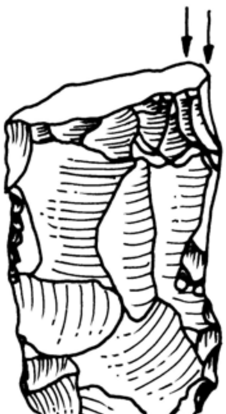


PIT O / ID 1145

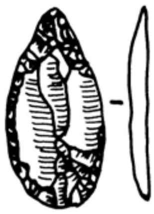


PIT O / ID 1146

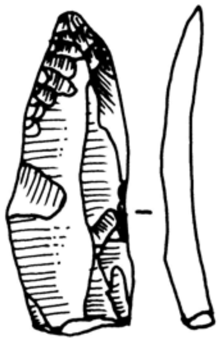
PIT O / ID 1142



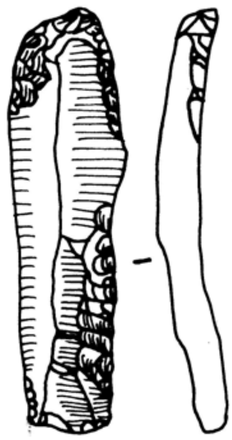
PIT O / ID 1149



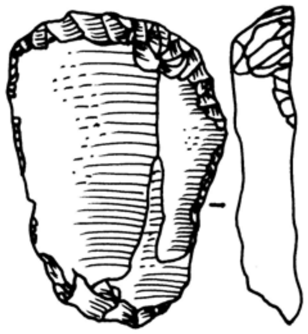
PIT O / ID 1340

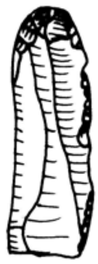


PIT O / ID 1338

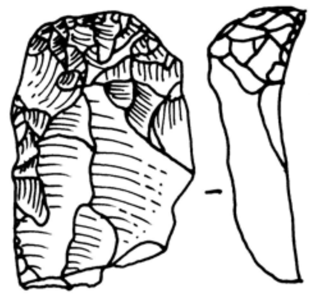


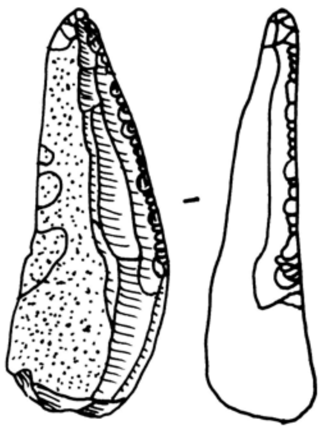
PIT O / ID 1339

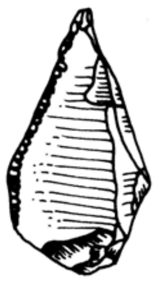

PIT O / ID 1153


PIT O / ID 1139

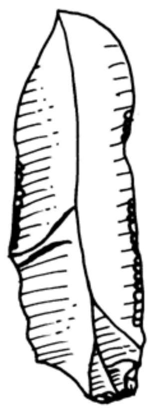

PIT O / ID 1150

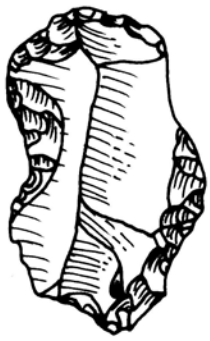

PIT O / ID 1152

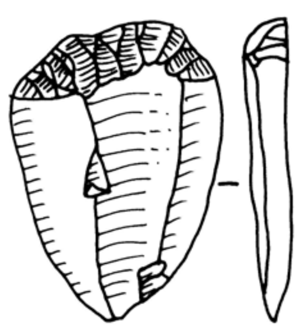

PIT O / ID 1341

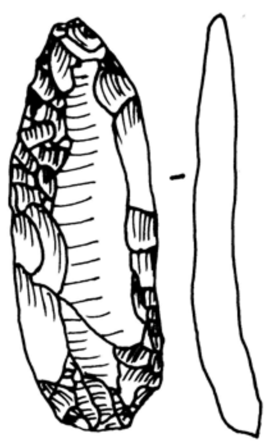

PIT O / ID 1343

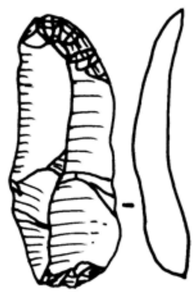

PIT O / ID 1337

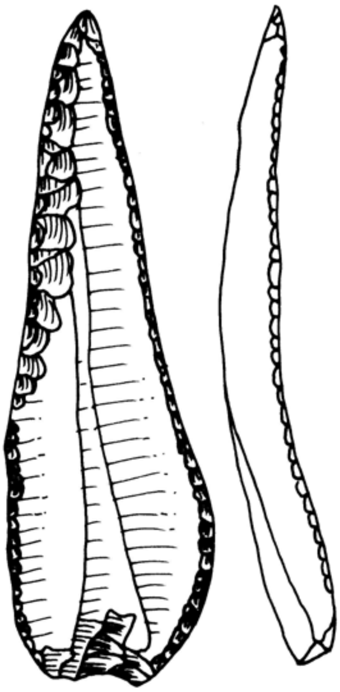

PIT O / ID 1344

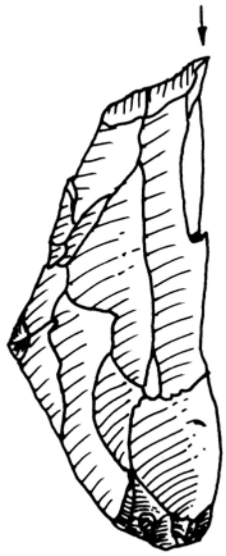

PIT PQR / ID 1144

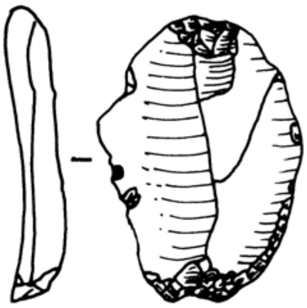

PIT PQR / ID 1346


PIT PQR / ID 1241


PIT PQR / ID 1231



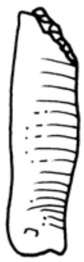


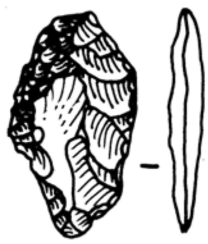


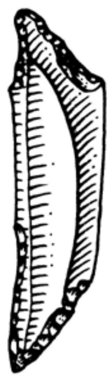
PIT PQR / ID 1335

PIT PQR / ID 1349

PIT PQR / ID 1347





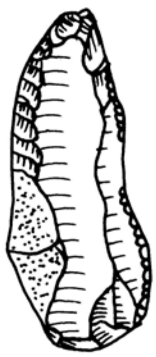


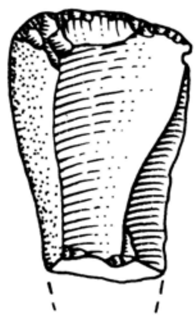
PIT PQR / ID 1351

PIT PQR / ID 1357

PIT PQR / ID 1237

PIT PQR / ID 1236



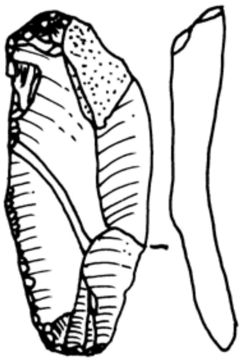


PIT PQR / ID 1232

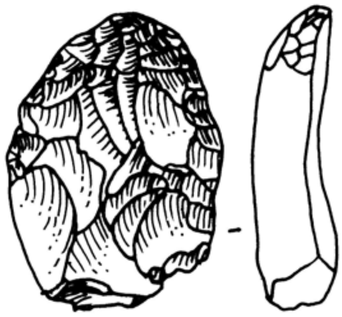
PIT PQR / ID 1239

PIT PQR / ID 1230

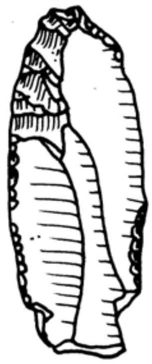
PIT PQR / ID 1243



PIT PQR / ID 1233

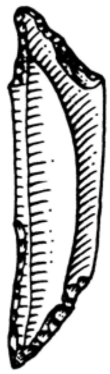


PIT PQR / ID 1234



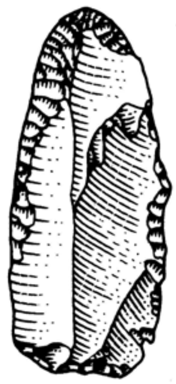
PIT PQR / ID 1238

PIT PQR / ID 1237

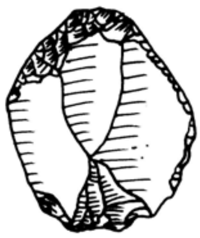


PIT PQR / ID 1236

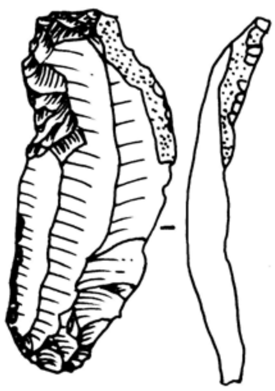
PIT PQR / ID 1226



PIT PQR / ID 1224



PIT PQR / ID 1227



PIT PQR / ID 1240

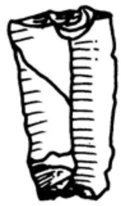
PIT PQR / ID 1238

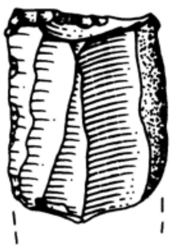
PIT S / ID 1285


PIT S / ID 1283

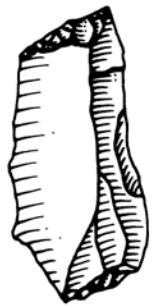

PIT S / ID 1286


PIT S / ID 1287


PIT S / ID 1288


PIT S / ID 1289


PIT S / ID 1292

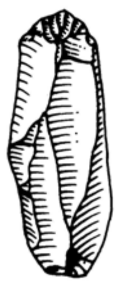

PIT S / ID 1293

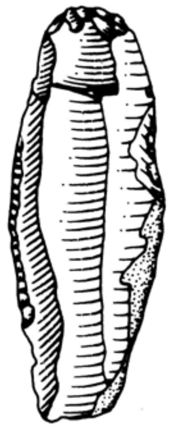

PIT S / ID 1290


PIT S / ID 1291

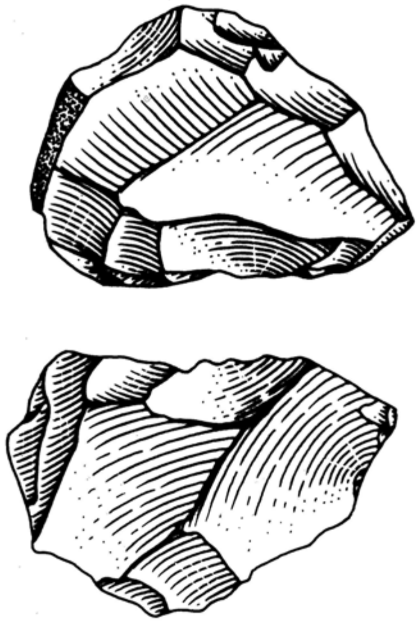

PIT S / ID 1294


PIT S / ID 1295


PIT S / ID 1296

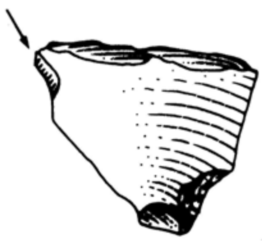


PIT S / ID 1282 PIT S / ID 1284

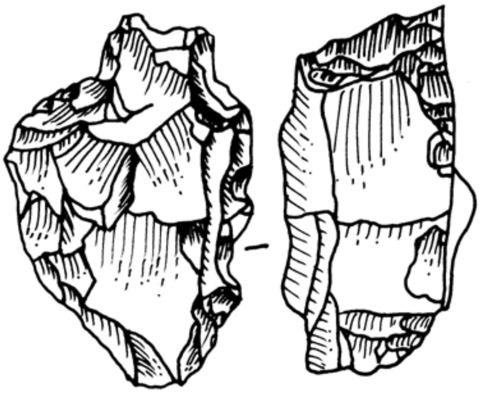


PIT S / ID 4458

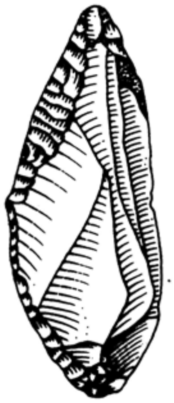
PIT S / ID 4459



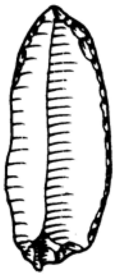
PIT U / ID 1299 PIT U / ID 1300 PIT U / ID 1297



PIT U / ID 1298



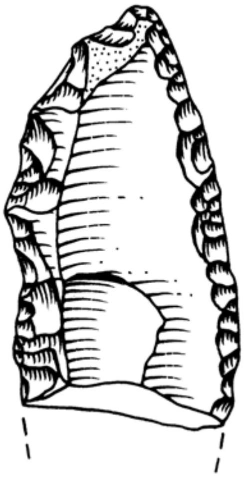
PIT V / ID 1276



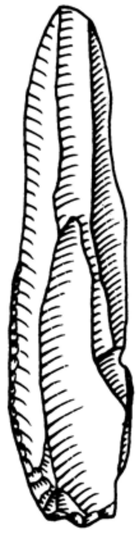
PIT V / ID 1281

PIT V / ID 1278

PIT V / ID 1277

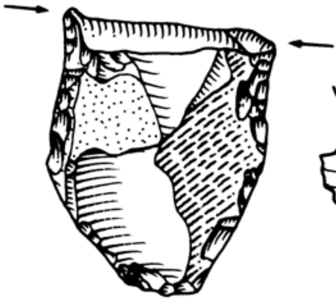


PIT V / ID 1266

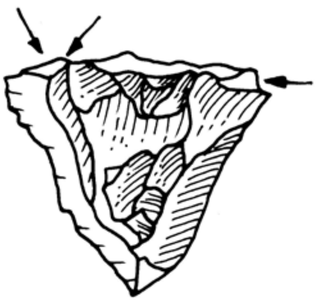


PIT V / ID 1280

PIT V / ID 1265



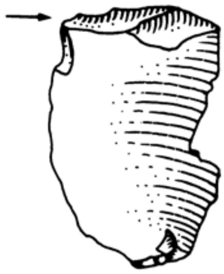
PIT V / ID 1267



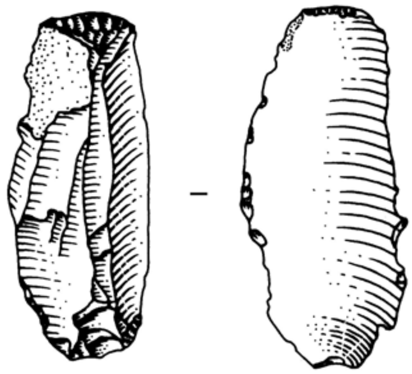
PIT W / ID 1279

PIT W / ID 1268

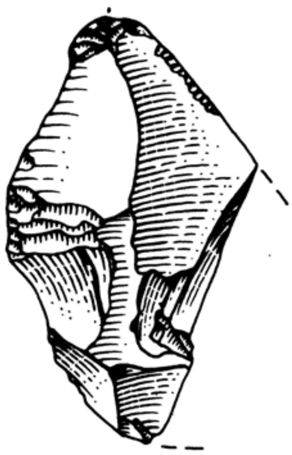
PIT W / ID 1269



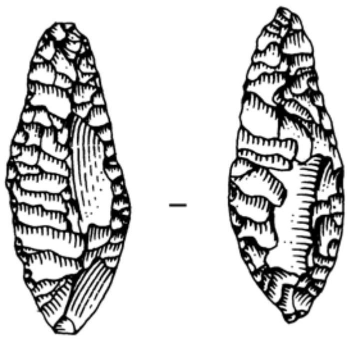
PIT W / ID 1270



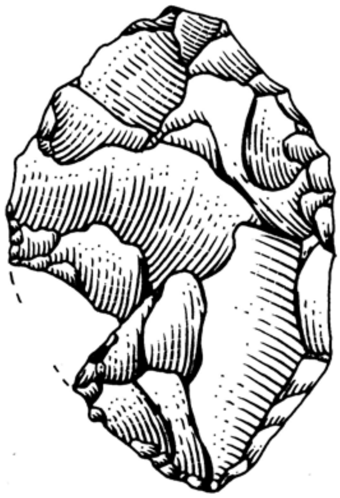
PIT W / ID 1274



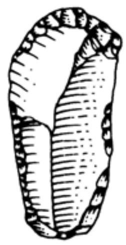
PIT W / ID 1271



PIT W / ID 1308



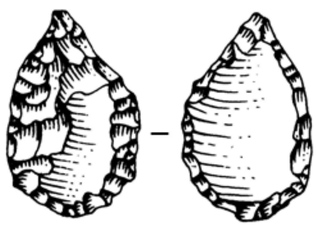
PIT W / ID 1306



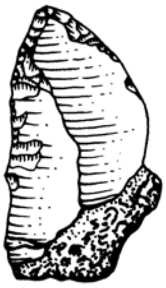
PIT W / ID 1307

PIT W / ID 1312

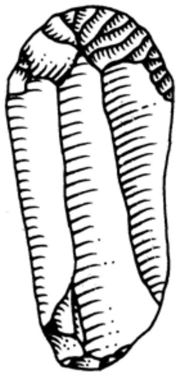
PIT W / ID 1311



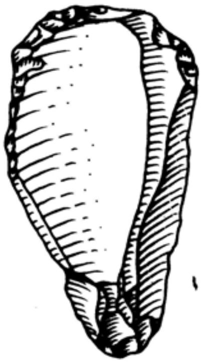
PIT W / ID 1310



PIT W / ID 1309

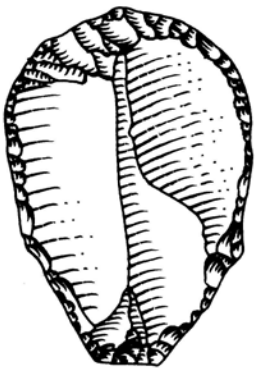


PIT Z / ID 1183

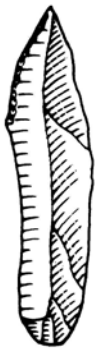


PIT Z / ID 1182

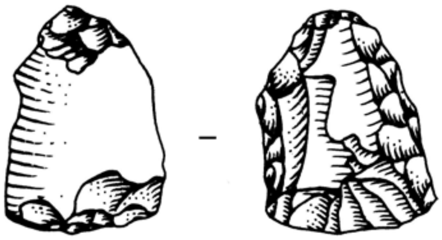
PIT Z / ID 1184



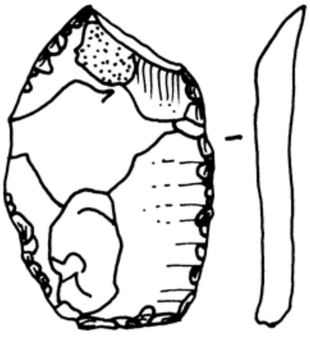
PIT Z / ID 1186



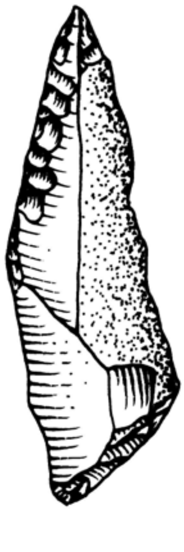
PIT Z / ID 1313



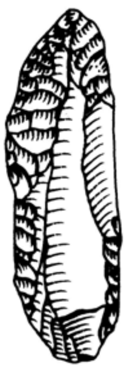
PIT Z / ID 1185



PIT Z / ID 1118



PIT Z / ID 1120



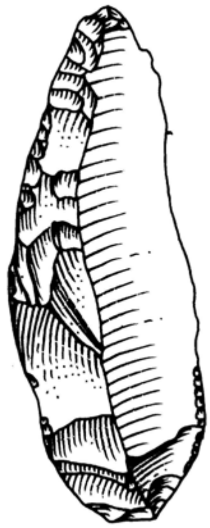
PIT Z / ID 1119

PIT Z / ID 1314

PIT Z / ID 1122

PIT Z / ID 1123

PIT Z / ID 1124



PIT Z / ID 1125

Appendix 3

ROCCA DI RIVOLI DATABASE

Bibliography

Affolter J., 1999. Caractérisation pétrographique et utilisation préhistorique de quelques matériaux siliceux alpines. In Della Casa P. (ed.), *PAESE '97*, UPA 55. Bonn: Habelt; pp. 253-256.

Affolter J., 2002. *Provenance des silex préhistoriques du Jura et des régions limitrophes*. Neuchâtel: Musée cantonal d'archéologie.

Ahler S.A., 1989. Mass analysis of flaking debris: studying the forest rather than the tree. *APAAA*, 1: 85-118.

Ammerman A.J. and Cavalli Sforza L.L., 1973. A population model for the diffusion of early farming in Europe. In Renfrew C. (ed.), *The explanation of cultural change: models in prehistory. Proceedings of a meeting of the research seminar in archaeology and related subjects held at the Universtiy of Sheffield*. London: Duckworth, pp. 343-357.

Ammerman A.J. and Feldman M.W., 1974. On the "making" of an assemblage of stone tools. *AA*, 39: 610-616.

Ammerman A.J. and Polglase C., 1993. The exchange of obsidian at Neolithic sites in Italy. In Healy F. and Scarre C. (eds.), *Trade and exchange in European prehistory*. Oxford: Oxbow Books; pp. 101-107.

Ammerman A.J. and Polglase C., 1998. Obsidian at Neolithic sites in Northern Italy. *PA*, 34: 291-296.

Anderson-Gerfaud P., 1983. A consideration of the uses of certain backed and lustered stone tools from Late Mesolithic and Natufian levels of Abu Hereyra and Mureybet (Syria). In Cauvin M.C. (ed.), *Traces d'Utilization sur les Outils Neolithique du Proche-Orient*. Lyon; pp. 77-106.

Andrefsky W. Jr., 1991. Inferring Trends in Prehistoric Settlement Behavior from Lithic Production Technology in the Southern Plains. *NAA*, 12: 129-144.

Andrefsky W. Jr., 1994. Raw material availability and the organization of technology. *AA*, 59: 21-34.

Andrefsky W. Jr., 1998. *Lithics. Macroscopic Approaches to Analysis*. Cambridge Manual in Archaeology. Cambridge: CUP.

Andrefsky W. Jr., 2001. *Lithic Debitage: Context, Form, and Meaning*. Salt Lake City: University of Utah Press.

Apel J., 2001. *Daggers, Knowledge and Power*. Uppsala: Coast to Coast Books.

Arnold D.E., 1984. Social interaction and ceramic design: Community-wide correlates in Quinua, Peru. In Rice P.M. (ed.), *Pots and Potters: Current Approaches in Ceramic Archaeology*. Monograph XXIV. Los Angeles: Institute of Archaeology University of California; pp. 133-161.

Aspes A., 1984. Storia delle ricerche. In Aspes A., (ed.), *Il Veneto nell'antichità. Preistoria e*

Protostoria, vol. I. Verona: Banca Popolare di Verona; pp. 3-39.

Astruc L., 2005. Avant-Propos. In Astruc L. (ed.), *Au-delà de la notion de techologie expédiente. Outillages lithiques au Néolithique*. Table-ronde. Cahier des themes transversaux ArScAn 2003/2004. Nanterre: CNRS.

Audouze F., 1988. Des modèles et des faits: les modèles de A. Leroi-Gourhan et de L. Binford confrontés aux résultats récents. *BSPF*, 84: 343-352.

Audouze F., 2002. Leroi-Gourhan, a philosopher of technique and evolution. *Journal of Archaeological Research*, 10 (4): 277-306.

Bagolini B., 1968. Ricerche sulle dimensioni dei manufatti litici preistorici non ritoccati. *AF*, Sez. XV, Vol. I, No. 10 : 195-219.

Bagolini B., 1970. Ricerche tipologiche sul gruppo dei foliati nelle industrie di età olocenica della Valle Padana. *AF*, Sez. XV, Vol. I, No. 11 : 221-245.

Bagolini B., 1980a. *Introduzione al Neolitico dell'Italia settentrionale nel quadro dell'evoluzione delle prime culture agricole europee*. Pordenone, Suppl. to Bollettino della Società Naturalisti "Silvia Zenari", 9.

Bagolini B., 1980b. *Il Trentino nella Preistoria del mondo alpino. Dagli accampamenti sottoroccia alla città quadrata*. Trento.

Bagolini B., 1984. Neolitico. In Aspes A., (ed.), *Il Veneto nell'antichità. Preistoria e Protostoria*, vol. I. Verona: Banca Popolare di Verona; pp. 323-447.

Bagolini B., 1987. Vallée de l'Adige. Naissance des premiéres communautés paysannes dans un territoire alpin. In Guilane J., Courtin J., Roudil J-L. and Vernet J.-L. (eds.), *Premières communautés paysanne en Méditerranée occidentale. Actes du Colloque Internationale du C.N.R.S., Montpellier, 26-29 avril 1983*, UISPP. Paris: CNRS.; pp. 445-459.

Bagolini B., 1990. Contacts entre les courants danubiens et méditerranées en Italie du Nord. In Cahen D. and Otte M. (eds.), *Rubané et Cardial. Actes du Colloque de Liége, Nov. 1988.* Liége: ERAUL 39; pp. 73-81.

Bagolini B.,1990-1991. Il neolitico varesino nel quadro culturale dell'area padano-alpina centrale. *Sibrium*, XXI: 3-8.

Bagolini B., 1992. Il Neolitico dell'Italia settentrionale. In Guidi A. and Piperno M. (eds.), *Italia preistorica*. Bari: Laterza; pp. 274-305.

Bagolini B., Barbacovi F., Biagi P., 1979. *Le Basse di Valcalaona (Colli Euganei). Alcune considerazioni su una facies con vasi a bocca quadrata e sulla sua collocazione cronologico-culturale*. Brescia: Monografie di Natura Bresciana, 3, pp. 3-72.

Bagolini B. and Biagi P., 1975. Il neolitico del Vhò di Piadena. *PA* 11: 1-45.

Bagolini B. and Biagi P., 1977. Le più antiche facies ceramiche dell'ambiente padano. *RSP*, XXXII: 219-233.

Bagolini B. and Biagi P., 1985. Balkan influences in the Neolithic of Northern Italy. *PA*, 21: 49-57.

Bagolini B. and Biagi P., 1988. The first Neolithic chipped stone assemblages of northern Italy. In J.K. Kozlowski and S.K. Kozlowski (eds.), *Chipped stone industries of the early farming cultures in Europe.* Warsaw: Warsaw University, Archeologia Interregionalis Series; pp. 423-448.

Bagolini B. and Biagi P., 1990. The radiocarbon chronology of the Neolithic of and Copper Age of Northern Italy. *Oxford Journal of Archaeology*, 9 (1): 1-23.

Bagolini B. and Broglio A., 1985. Il ruolo delle Alpi nei tempi preistorici. In *Studi di Paletnologia in onore di S.M. Puglisi*. Roma, pp. 663-705

Bagolini B., Ferrari A. and Steffè G., 1998. Il recente Neolitico di Spilamberto (Modena). *BPI*, 89 (n.s. VII): 93-200.

Bagolini B. and Nisi D., 1976a. Monte Baldo (Verona-Trento). *PA*, 12: 237-241.

Bagolini B. and Nisi D., 1976b. Fontana de la Teia, Monte Baldo (Verona). *PA*, 12: 243-244.

Bagolini B. and Nisi D., 1980. Malga di Monte Albaro (Baldo); Monte Cimo-Baldo; Monte Moscal-Baldo-Verona; Praelle di Spiazzi, Baldo; Tratto Spino-Baldo. *PA*, 16: 120-121 and 124-125.

Bagolini B. and Nisi D., 1981. La presenza umana preistorica sul Baldo. *Natura Alpina*, XXXII: 91-104.

Bagolini B. and Pedrotti A., 1998. L'Italie septentrionale: vue generale. In *Atlas du Neolithique Européen*, *l'Europe Occidentale*. Liége: ERAUL; pp. 233-341.

Bagolini B. and Scanavini A., 1974. Ricerche funzionali e tipologiche su un gruppo di grattatoi neolitici. Annali dell' Università di Ferrara, Sez. XV, vol. 2(5): 217-246.

Bailly M., 2006. Faire simple: oui, mais comment? Production lithique et dynamique des relations sociales dans le Néolithique moyen et le Néolithique final de l'arc jurassien. In Astruc L., Bon F., Lea V., Milcent P.-Y. and Philibert S. (eds.), *Normes techniques et pratiques sociales. De la simplicité des outillages pré- et protohistoiques*. XXVIe rencontres internationales d'archéologie et d'histoire d'Antibes. Antibes: Éditions APDCA; pp. 35-47.

Balfet H., 1975. Technologies. In Cresswell R. (ed.), *Éléments d'ethnologie*, 2. Paris: Colin; pp. 44-79.

Balout L., Biberson P. and Tixier J., 1967. L'Acheuléen de Ternifine (Algérie), gisement de l'Atlanthrope. *L'Anthropologie*, 71: 217-237.

Bamforth D.B., 1986. Technological efficiency and tool curation. *AA*, 51: 38-50.

Bamforth D.B., 1990. Settlement, raw material and lithic procurement in the Central Mojave Desert. *Journal of Anthropological Archaeology*, 9: 70- 104.

Bamforth D.B., 1991. Technological organization and hunter-gatherer land use: A California example. *AA*, 56: 216-234.

Bamforth D.B. and Finlay N., 2008. Introduction: archaeological approaches to lithic production skill and craft learning. *JAMT*, 15(1): 1-27.

Banning E.B., 2000. Classification, grouping, typology, [in:] ARH 312Y - Archaeological Laboratory, Systematics, (28.10.2012). http://homes.chass.utoronto.ca/~banning/ARH%20312/312Ysyst.htm

Barcelò J.A., 1996. Heuristic classification and fuzzy sets. New Tools for archaeological typologies. In Kamermans H. and Fennema K. (eds.), *Interfacing the Past. Computer Applications and Quantitative Methods in Archaeology CAA95*. Vol. I (Analecta Praehistorica Leidensia 28). Leiden: Institute of Prehistory, University of Leiden; pp. 155-164.

Barfield L.H., 1965. Scavi sul Monte Rocca presso Rivoli Veronese (Nota preliminare. Campagna 1965). In *Atti della X Riunione Scientifica I.I.P.P.;* pp. 139-145.

Barfield L.H, 1966. The excavations on the Rocca di Rivoli (Verona). *MMCSN*, XIV: 1-100.

Barfield L.H., 1970. L'insediamento neolitico "ai Corsi" presso Isera (Trento). (Ricerche 1967). *Studi Trentini di Scienze Naturali,* Sez. B, 47 (1): 56-77.

Barfield L.H., 1972. *The first Neolithic cultures of north-eastern Italy.* Köln: Fundamenta, A/3, VIII.

Barfield L.H., 1987. The Italian dimension of the Beaker problem. In Waldren W.H. and Kennard R.C. (eds.), *Bell Beakers of the Western Mediterranean.* Oxford: BAR IS 331, pp. 499-522.

Barfield L.H.,1987. Recent work on sources of Italian flint. In *The human uses of flint and chert. Proceedings of the 4th International Flint Symposium, Brighton Polytechnic 1983.* Cambridge: CUP; pp. 231-239.

Barfield L.H., 1990. The lithic factor: a study of the relationshio between stone resources and human settlement in the Monti Lessini and the Southern Alps. In Biagi P. (ed.), *The Neolithisation of the Alpine region.* Monografie di Natura Bresciana 13; pp. 147-157.

Barfield L.H., 1994. The exploitation of flint in the Monti Lessini, Northern Italy. In Ashton N and David A. (eds.), *Stories in stone.* Lithic Studies Occasional Papers, No. 4; pp. 71-83.

Barfield L.H., 1999. Neolithic and Copper Age flint exploitation in Northern Italy. In Della Casa P. (ed.), *Prehistoric alpine environment, society and economy.* Papers of the International Colloquium PAESE. Zurich; pp. 245-252.

Barfield L.H., 2000. Commercio e scambio nel Neolitico dell'Italia settentrionale. In A. Pessina, G. Muscio (eds.), *La neolitizzazione tra oriente e occidente. Atti del Convegno di Studi, Udine, 23-24 aprile 1999.* Udine: Edizioni del Museo Friulano di Storia Naturale; pp. 55-66.

Barfield L.H., 2011. Le silex des Monts Lessini (Vérone, Italie). Exploitations et circulations préhistoriques. In Borrello M.A. (ed.), Les hommes préhistoriques et les Alpes. BAR IS 9999. Oxford; pp. 135-146.

Barfield L.H. and Bagolini B., 1976. *Excavations at Rocca di Rivoli, Verona, 1963-1968.* MMCSN (IIa Serie), Sezione di Scienze dell'Uomo, n. 1, Verona.

Barfield L.H. and Bagolini B., 1991. The European context of Northern Italy during the Third millennium. In Lichardus J. and Echt R. (eds.), *Die Kupferzeit als historische Epoche; Symposium Saarbrücken und Otzenhausen 6 - 13.11.1988*. Bonn: Habelt, Saarbrücker Beiträge zur Altertumskunde 55; pp. 287-297.

Barfield L.H. and Broglio A., 1986. *L'Insediamento Neolitico di Molino Casarotto nelle Valli di Fimon (Colli Berici, Vicenza)*, Parte 1. Vicenza: Accademia Olimpica di Vicenza.

Barfield L.H. and Buteux S., 1999. Rocca di Manerba, Rocca di Rivoli, Rocca di Garda e l'uso di siti arroccati nella preistoria. In: Brogiolo G.R (ed.), *Progetto archeologico Garda I*. Mantova, pp. 13-27.

Barfield L.H. and Buteux S., 2002. The Rocca di Manerba: a late Neolithic fortified and terraced site in northern Italy. *Antiquity*, 76: 621-622.

Barfield L.H. and Chelidonio G., 1992-1993. Indagini stratigrafiche e di superficie nell'area di Ponte di Veja. *Annuario Storico della Valpolicella*, XI: 67-76.

Barfield L.H. and Wardle D., 2005. The white house at Rivoli Veronese.*Quaderni di archeologia del Veneto*, 21: 82-85.

Baumler M.F. and Downum C.E., 1989. Between micro and macro: a study in the interpretation of small-sized lithic debitage. In Amick D.S. and Mauldin R.P. (eds.), *Experiments in Lithic Technology*. BAR IS, 528. Oxford; pp. 101-116.

Beck C. and Jones G.T., 1989. Bias and archaeological classification.*AA*, 54: 244-262.

Bender B., 1985a. Prehistoric developments in the American mid-continent and in Brittany, north-west France. In Price T.D. and Brown J. (eds.), *Prehistoric hunter-gatherers: the emergence of cultural complexity*. Orlando, Florida: Academic Press, pp. 21-58.

Bender B., 1985b. Emergent tribal formations in the American mid-continent. *AA*, 50 (1): 52-62.

Bergman C.A., 1987. *Ksar Akil, Lebanon : A Technological Analysis of the Later Palaeolithic Levels*. Vol. II: levels XIII-VI. BAR IS, 329. Oxford.

Bernabò Brea L., 1950. L. Bernabò Brea, Il neolitico a ceramica impressa e la sua diffusione nel Mediterraneo. *Rivista di Studi Liguri* XVI (1): 25-36.

Bernabò Brea M., Cattani M., Farello P. and Nisbet R., 1994. Una struttura insediativa del Neolitico superiore a S. Andrea di Travo (PC). *Quaderni del Museo Archeologico Etnologico di Modena*, I: 55-87.

Bernabò Brea M. and Mazzieri P., 2010. Oggetti e contesti rituali nella cultura VBQ dell'Emilia occidentale. *Padusa*, 45: 7-41.

Bernabò Brea M., Salvadei L., Maffi M., Mazzieri P., Mutti A. and Sandias M., 2006. Le necropolis VBQ dell'Emilia occidentale: rapporti con gli abitati, rituali, corredi, dati antropologici. In Pessina A. and Visentini P. (eds.), *Preistoria dell' Italia settentrionale. Studi in ricordo di Bernardino Bagolini* (Proceedings). Udine; pp.169-185.

Bernabò Brea M., Salvadei L., Maffi M., Mazzieri P., Mutti A. and Sandias M., 2007. Les sépultures du Néolithique moyen de l'Emilie occidentale: rituels, rapports avec les habitats, données anthropologiques. In Moinat P. and Chambon P. (eds.), *Les cistes de*

Chamblandes et la place des coffres dans les pratiques funéraires du Néolithique moyen occidental. (Proceedings) Cahiers d'Archéologie Romande 110. Lausanne and Paris: Société préhistorique française XIII;pp. 325-335.

Bertola S., 2006. La Provenienza della selce. In Ferrari S. and Bertola S*., Industrie litiche dal territorio di Montecchio Maggiore (Vicenza)*. Studi e ricerche, vol. 13. Montecchio Maggiore (Vicenza): Comune di Montecchio Maggiore e Associazione Amici del Museo Zannato; pp. 57-70.

Beyries S., 1988. Functional variability of lithic sets in the Middle Paleolithic. *Upper Pleistocene Prehistory of Western Eurasia*, 1: 213-223.

Biagi P., 1972. Il Neolitico di Quinzano Veronese. *MMCSN*, XX: 413-485.

Biagi P., 1986. Nuovi materiali neolitici da Castelnuovo di Teolo (Padova). *Natura Bresciana*, 21: 187-193.

Biagi P., 1987. Aspetti dell'archeologia in Lombardia: IX-IV millennio b.c. In *Atti del I Convegno archeologico regionale (Como 1985)*; pp. 379-396.

Biagi P., 1991. The prehistory of the Early Atlantic period along the Ligurian and Adriatic coasts of Northern Italy in a Mediterranean perspective. *Rivista di Archeologia*, XV: 46-54.

Biagi P., 1995. The flint assemblages. In Biagi P. (ed.), *L'insediamento neolitico di Ostiano-Dugali Alti (Cremona) nel suo contesto ambientale ed economico*. Monografie di Natura Bresciana, 22. Brescia: Museo Civico di Scienze Naturali di Brescia; pp. 43-50.

Biagi P., Barker G.W.W., Cremaschi M., 1983*. La stazione di Casatico di Marcaria (Mantova) nel quadro paleoambientale ed archeologico dell'Olocene antico della Val Padana centrale*. Studi archeologici, 2. Bergamo.

Biagi P., Castelletti L., Cremaschi M., Sala B. and Tozzi C., 1980. Popolazione e territorio nell'Appennino Tosco-Emiliano e nel tratto centrale del bacino del Po, tra il IX ed il V millennio. *Emilia Preromana*, 8: 13-36.

Biagi P. and Nisbet R., 1987. The Earliest Farming Communities in Northern Italy. In Guilaine J, Courtin J., Roudil J.-L. and Vernet J.-L. (eds.), *Premières Communautés Paysannes en Méditerranée Occidentale*. Paris: CNRS, pp. 447-453.

Biagi P. and Spataro M., 2001. Plotting the evidence: some aspects of the radiocarbon chronology of the Mesolithic-Neolithic transition in the Mediterranean basin. *Atti della Società per la Preistoria e Protostoria della Regione Friuli-Venezia-Giulia*, 12 (1999-2000): 15-54.

Biagi P., Starnini E. and Voytek B.A., 1993. The Late Mesolithic and Early Neolithic Settlement of Northern Italy: Recent Considerations. *Porocilo o raziskovanju paleolitika, neolitika in eneolitika v Slovenij* 21: 45-67.

Biagi P. and Voytek B.A., 1992. The flint assemblages from Pits XVIII and XXXII of the Early Neolithic site of Campo Ceresole at Vhò di Piadena (Cremona, northern Italy). *Natura Bresciana*, 27: 243-288.

Bianchin Citton E., Conci C., Dal Santo N., Ferrari S., Mottes E., Salzani P., Visentini P. and

Ziggiotti S., in press. Approccio tecno-tipologico e funzionale ai complessi litici datati tra la metà del V millennio e la metà del IV millennio a.C. di Friuli, Veneto e Trentino. In *Neolitica, Atti del Convegno di Firenze 2009*.

Binder D. and Perlès C. avec la collaboration de Lechevallier M. and Inizan M.-L., 1990. Stratégies de gestion des outillages lithiques au nèolithique. *Paleo*, 2: 257-283.

Binford L.R., 1962. Archaeology as anthropology. *AA*, 28: 217-225.

Binford L.R., 1965. Archaeological systematics and the study of culture process. *AA*, 31 (2): 203-210.

Binford L.R., 1972. Contemporary model building: paradigms and the current state of Paleolithic research. In Clarke D.L. (ed.), Models in Archaeology. London: Methuen; pp. 109-166.

Binford L.R., 1973. Interassemblage variability - the Mousterian and the functional argument. In Renfrew C. (ed.), *Explanation of cultural change: models in prehistory*. London: Duckworth; pp. 227-254.

Binford L.R., 1977. Forty-seven trips: a case study in the character of archaeological formation processes. In Hall E. (ed.), *Contributions to anthropology: the interior peoples of northern Alaska*. Mercury series no. 49. Ottawa: National Museum of Man; pp. 299-351.

Binford L.R., 1978. *Nunamiut Ethnoarchaeology*. New York: Academic Press.

Binford L.R., 1979. Organization and formation processes: looking at curated technologies. *Journal of Anthropological Research*, 35: 255-273.

Binford L.R., 1980. Willow smoke and dog's tails: hunter-gatherer settlement systems and archaeological site formation. *AA*, 45: 4-20.

Binford L.R., 1983. *Working at Archaeology*. New York: Academic Press.

Binford L.R., 1986. An Alyawara Day: Making Men's Knives and beyond. *AA*, 51: 547-562

Binford L.R., 1989. *Debating Archaeology*. Studies in archaeology. San Diego: Academic Press.

Binford L.R. and Binford S.R., 1966. A preliminary analysis of functional variability in the Mousterian of Levallois Facies. *American Anthropologist*, 68: 238-295.

Binford L. and Stone N.,1985. "Righteous Rocks" and Richard Gould: some observations on "Misguided Debate". *AA*, 50: 151-153.

Bleed P., 1986. The optimal design of hunting weapons: maintainability or reliability. *AA*, 51: 737-747.

Bleed P., 2001. Trees, chains, links or branches: conceptual alternatives for consideration of stone tool production and other sequential activities. *JAMT*, 8: 101- 127.

Bodu P., Karlin C. and Ploux S., 1990. Who's who? The Magdalenian flintknappers of Pincevent, France. In Cziesla E. (ed.), *The Big Puzzle: International Symposium on Refitting Stone Artifacts*, *Monrepos, 1987*. Studies in Modern Archaeology, Vol. 1; pp. 143-164.

Boëda E., 1994. *Le concept Levallois: variabilité des méthodes*. Prigonrieux: Archéo éditions.

Bordaz J., 1969. The threshing sledge - ancient Turkish grain separating method still proves efficient. *Natural History*, 74(4): 216-229.

Bordes F., 1947. Etude comparative des différentes techniques de taille du silex et des roches dures. *L'Anthropologie*, 51: 1-29.

Bordes F., 1961. *Typologie du Paléolithique Ancien et Moyen*. Publications de l'Institut de préhistoire de l'Université de Bordeaux. Mémoire 1. Bordeaux: Imprimeries Delmas.

Bordes F., 1969. Traitement thermique du silex au Solutrérn. Bulletin de la Société Préhistorique Française, 70: 197.

Bordes F., 1972. *A Tale of Two Caves*. New York: Harper and Row.

Bordes F., 1973. On the chronology and contemporaneity of different palaeolithic cultures in France. In Renfrew C. (ed.), *The Explanation of Culture Change*. London: Duckworth; pp. 217-226.

Bordes F., 1978. Typological variability in the Mousterian layers at Pech de l'Aze I, II, and IV. *Journal of Anthropological Research*, 34(2): 181-193.

Bordes F., 1981. Vingt-cinq ans après: Le complexe moustérien revisité. *Bulletin de la Société Préhistorique Française*, 78: 77-87.

Bordes F. and Crabtree D.E., 1969. The Corbiac blade technique and other experiments. *Tebiwa*, 12(2): 1-21.

Bordes F. and De Sonneville-Bordes D., 1970. The significance of variability in Palaeolithic assemblages. *World Archaeology*, 2(1): 61-73.

Bourdieu P., 1977. *Outline of a theory of practice*. Cambridge Studies in Social Anthropology 16. Cambridge: CUP.

Bourdieu P., 1990. *The Logic of Practice* (trans. Richard Nice). London: Polity Press.

Bradbury A.P. and Carr P.J., 1995. Flake typologies and alternative approaches: an experimental assessment. *Lithic Technology*, 20: 100-115.

Bradley B.A., 1975. Lithic reduction sequences: a glossary and discussion. *World Anthropology*, 5-13.

Bradley R.J., 1990. *The Passage of Arms: archaeological analysis of prehistoric hoards and votive deposits*. Cambridge: CUP.

Bradley R.J., 2007. *The Prehistory of Britain and Ireland*. Cambridge: CUP.

Bradley R.J. and Edmonds M., 1993. *Interpreting the axe trade. Production and exchange in Neolithic Britain*. Cambridge: CUP.

Bressy C., Bellot-Gurlet L., D'Anna A., Pelletier D. and Tramoni P., 2003. Provenance et gestion des matieres premieres lithiques du site neolithiques ancien cardial de Renaghju (Sartene, Corse-du-Sud). In Surmely F. (ed.), *Les matières premières lithiques en Préhistoire.* Actes de la Table ronde internationale d'Aurillac. Préhistoire du Sud-Ouest, supplément n° 5, pp. 71-79.

Broglio A., 1961. *Ricerche statistiche e nuovi orientamenti sull'origine e sull'evoluzione delle industrie del Paleolitico superiore dell'Europa occidentale*. Annali Università di Ferrara, N.S., Sez. XV (V): 89-132.

Broglio A. and Lollini D.G., 1963. Nuova varietà di bulino su ritocco a stacco laterale nella industria del Neolitico medio di Ripabianca di Monterado (Marche). *AF*, Sez. XV, 1(7): 143-155.

Bronk Ramsey C., 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon*, 51(1): 337-360.

Brück J., 1999. Ritual and rationality: some problems of interpretation. *Journal of European Archaeology*, 2(3): 313-344.

Brumfiel E.M., 1992. Distinguished lecture in archeology: breaking and entering the ecosystem - gender, class and faction steal the show. *American Anthropologist* (n.s.), 94: 551-567.

Burroni D., Donahue R.E., Pollard A.M. and Mussi M., 2002. The surface alteration features of flint artefacts as a record of environmental processes. *JAS*, 29: 1277-1287.

Burton J., 1984. Quarrying in a tribal society. *World Archaeology*, 16: 234-247.

Butler C., 2005. *Prehistoric flintwork*. Stroud: Tempus Pub Limited.

Cahen D., Karlin C., Keeley L.H. and van Noten F., 1980. Méthodes d'analyse technique, spatiale et fonctionnelle d'ensembles lithiques. *Helinium*, 20: 209-259.

Cahen D., Keeley L.H., Van Noten F.L., Behm J.A., Busby C.I., Dunnell R.C., ... & Movius Jr. H.L., 1979. Stone tools, toolkits, and human behavior in prehistory [and comments and reply]. *Current Anthropology*, 20: 661-683.

Candelato F., Ferrari A., Isotta L.C., Longo L., Petruziello A., Rioda V., Signori G., 2003. Approccio integrato per la determinazione della provenienza della materia prima nella preistoria veronese. Il caso della selce. In: *L'informazione Territoriale e la dimensione tempo. Atti della Conferenza Nazionale ASITA*, Verona 28-31 ottobre 2003. Vol 1, pp. 561-566.

Candussio A., Ferrari A., Ferrari U., Messori A., Pessina A., Pez O., Quagliaro F., Tosone R. and Tullio B., 1989. Nuovi siti mesolitici in provincia di Udine. *Natura Bresciana*, 26: 251-288.

Castañeda N., 2009. A methodological approach to core analysis. *Human evolution*, 24: 107-119.

Cavulli F., 2008. *Abitare il Neolitico. Le più antiche strutture antropiche del Neolitico in Italia Settentrionale*. PA 43, Supplemento 1.

Chapman J.C., 1999. Deliberate house-burning in the prehistory of Central and Eastern Europe. In Gustafson A. and Karlsson H. (eds.), *Glyfer och arkeologiska rum - en vänbok till Jarl Nordbladh*. Goteborg: Goteborgs Universitet; pp. 113-126.

Chapman J.C., 2000a. *Fragmentation in Archaeology: people, places and broken objects*. London: Routledge.

Chapman J.C., 2000b. ‘Rubbish-dumps’ or ‘places of deposition’? Neolithic and Copper Age settlements in central and eastern Europe. In Ritchie A. (ed.), *Neolithic Orkney in its European context*. McDonald Institute for Archaeological Research. Cambridge: University of Cambridge Press; pp. 347-362.

Chapman J.C, 2000c. Pit-digging and structured deposition in the Neolithic and Copper Age. *Proceedings of the Prehistoric Society*, 66: 61-87.

Chapman J.C. and Gaydarska B., 2007. *Parts and Wholes. Fragmentation in Prehistoric Context*. Oxford: OxbowBooks.

Chase P.G., 1991. Symbols and Palaeolithic artifacts: style, standardization and the imposition of arbitrary form. *Journal of Anthropological Archaeology*, 10: 193-214.

Chatters J.C., 1987. Hunter-gatherer adaptations and assemblage structure. *Journal of Anthropological Archaeology*, 6: 335-375

Chazan M., 1997. Lead Review. Redefining Levallois. *Journal of Human Evolution*, 33: 719-735.

Chelidonio G., 1999. E’ in Lessinia la “Miniera del Similaun”. *Padusa Notiziario*, 10 (1/2): 1-10.

Chelidonio G., 2000. Folènde per 300 mila anni a Fosse (Sant’Anna d’Alfaedo). *Annuario Storico della Valpolicella*, XVI: 11-24.

Chelidonio G. and Zanini F., 2007. Una nuova area di officina litica tardo-preistorica in alta Lessinia (Verona, Italia). In *Actes du XIe Colloque sur les Alpes dans l’Antiquité Champsec, Val de Bagnes, Valais, Suisse*. Bulletin d’Etudes Préhistoriques et Archéologiques Alpines, pp. 409-416.

Chierici G., 1875. Quarto gruppo di fondi di capanne dell’età della pietra nella provincia di Reggio dell’Emilia. *BPI*, 7: 101-110.

Chierici G., 1877 Villaggio dell’età della pietra nella provincia di Reggio nell’Emilia. *BPI*, 3: 1-12.

Childe V.G., 1925. *The dawn of European civilization*. London: Kegan Paul, Trench, Trubner.

Clark J.D. and Kleindienst M.R., 1974. The Stone Age cultural sequence: terminology, typology and raw material. In Clark J.D. (ed.), *Kalambo Falls Prehistoric Site. Vol. II*. Cambridge: CUP; pp. 71-106.

Cohen I., 1987. Structuration theory and social praxis. In Giddens A. and Turner J. H. (eds.), *Social theory today*. Stanford California: Stanford University Press, pp. 273-308.

Coles J.M. and Orme B.J., 1977. Neolithic hurdles from Walton Heath, Somerset. *Somerset Levels Papers*, 3: 6-29.

Conati Barbaro C., Lemorini C. and Ciarico A., 2002. Osservazioni sul potenziale interpretative delle industrie litiche: un’applicazione a contesti del Neolitico tardo in Italia central. In Ferrari A. and Visentini P. (eds.), *Il declino del mondo neolitico. Ricerche in Italia centro-settentrionale fra aspetti peninsulari, occidentali e nord-alpini*. Atti del Convegno (Pordenone 2001). Pordenone: Quaderni del Museo Archeologico del Friuli Occidentale, 4; pp. 167-176.

Conkey M.W., 1990. Experimenting with style in archaeology: some historical and theoretical issues. In Conkey M.W. and Hastorf C. (eds.), *The uses of style in archaeology*. Cambridge: CUP, pp. 5-17.

Coote J. and Shelton A., 1992. *Anthropology, art, and aesthetics*. Oxford: Oxford University Press.

Cornejo L.E. and Galarce P., 2010. C index. Dimensioning the expedience/curative continuum in lithic technology. *Chungara*, 42(2): 393-404.

Costin C. and Hagstrum M., 1995. Standardization, labor investment, skill, and the organization of ceramic production in Late Prehistoric Highland Peru. *AA*, 60: 619-639.

Cotterell B. and Kamminga J., 1987. The formation of flakes. *AA*, 52: 675-708.

Cotterell B., Kamminga J. and Dickson F.P., 1985. The Essential Mechanics of Conchoidal Flaking. *International Journal of Fracture*, 20: 205-221.

Cottini M., Ferrari A., Pellegatti P., Petrucci G., Rottoli M., Tasca G. & Visentini P., 1996. Bannia Palazzine di Sopra (Fiume Veneto, Pordenone): scavo 1995. *Atti della Società per la Preistoria e Protostoria della Regione di Friuli-Venezia Giulia*, 10: 119-149.

Courtin J. and Villa P., 1982. *Une Experience de Pietinement. Bulletin de la Societe Prehistorique Française*, 79: 117-123.

Cowan F.L., 1999. Making sense of flake scatters: lithic technological strategies and mobility. *AA*, 64: 593-607.

Crabtree D.E., 1972. *An introduction to flint working*. Pocatello: Occasional papers of the Idaho State Museum 28.

Crabtree D.E. and Butler B.R., 1964. Notes on experiments in flintknapping: 1.Heat treatment of silica materials. *Tebiwa*, 7: 1-6.

Cremaschi M., 1981 . The source of flint artefacts from the central Po Plain and Apennine sites, between the 7th and the 2nd millennium BC. In Engelen F.H.G. (ed.), Third International Symposium on Flint. *Staringia*, 6: 139-142.

Cresswell R., 1972. Les trois sources d'une technologie nouvelle. In Thomas J. and Bernot L. (eds*.), Langues et techniques, nature et société, tome II, approche ethnologie, approche naturaliste*. Paris: Klincksiek, pp. 21-27.

Cresswell R., 1983. Transferts de techniques et chaînes opératoires. *Techniques et Culture*, 2: 145-164.

Cresswell R., 1990. "A new technology" revisited*. Archaeological Review from Cambridge*, 9 (1): 39-54.

Cresswell R., 1996. *Prométhée ou Pandore? Propos de technologie culturelle*. Paris: Editions Kimé.

Cristini V., 2007. *Gli uomini, la terra, la fede. Documenti dagli archive e immagini dal Medioevo al Novecento*. Cologna Veneta (Verona): L.G. Ambrosini & C.

Cross T.A. and Homewood P.W., 1997. Amanz Gressly's Role in Founding Modern Stratigraphy. *Geological Society of America Bulletin*, 109: 1617-1630.

Dal Santo N., 2003. Provenienza e utilizzo delle rocce silicee scheggiate del sito neolitico di Palù di Livenza (Pordenone). *Atti della Società per la Preistoria e Protostoria del Friuli Venezia Giulia*, XIV: 103-147.

Dal Santo N., 2005. Strategie e tecniche di lavorazione della selce: la tecnologia litica. In Visentini P. (ed.), *Bannia-Palazzine di Sopra. Una comunità preistorica del V millennio a.C.* Quaderni del Museo Archeologico del Friuli Occidentale 5. Pordenone: Comune di Pordenone Editore; pp. 101-108.

Dal Santo N., 2009. Sistemi tecnici a confronto: l'evoluzione delle industrie litiche dal Mesolitico recente all'Eneolitico nei siti del medio corso del Panaro. In Cardarelli A., Malnati L. (eds.), *Atlante dei Beni Archeologici della Provincia di Modena*, Vol. III: Alta Pianura e Collina. Modena; pp. 23-32.

Dal Santo N. and Ferrari A., 2005. Provenienza delle rocce silicee scheggiate. In Visentini P. (ed.), *Bannia-Palazzine di Sopra. Una comunità preistorica del V millennio a.C.* Quaderni del Museo Archeologico del Friuli Occidentale 5. Pordenone: Comune di Pordenone Editore; pp. 96-100.

Dal Santo N. and Mazzieri P., 2010. Il sito di VBQ iniziale di Ponte Ghiara (Parma). Le industrie litiche e ceramiche. *Origini*, XXXII (n.s. IV): 105-160.

Dal Santo N. and Mazzieri P., 2014. Connotazione e sviluppo diacronico del VBQ in Emilia occidentale in base alle industrie ceramiche e litiche. Gli esempi dei siti di Ponte Ghiara, Benefizio e via Guidorossi. Atti del Convegno "Il pieno sviluppo del Neolitico in Itaila" Finale 8-10 giugno 2009. *Rivista di Studi Liguri*, LXXVII-LXXIX: 419-427.

Dal Santo N. and Mazzieri P., in press. L'approvvigionamento delle rocce silicee scheggiate nel vbq dell'Emilia occidentale. In *Vasi a bocca quadrata. Evoluzione delle conoscenze, nuovi approcci interpretativi*, Atti del Convegno, Riva del Garda, 13-15 maggio 2009.

Daniels S.G.H., 1972. Research design models. In Clarke D. (ed.), *Models in Archaeology*. London: Methuen; pp. 201-229.

Dauvois M., 1976. *Precis de dessin dynamique et structural des industries lithiques prehistoriques*. Perigueux: Fanlac.

Dauvois M., 1981. De la simultanéité des concepts Kombewa et Levallois dans l'Acheuléen du Maghreb et du Sahara nord-occidental. *Préhistoire Africaine*, 6: 313-320.

David N., Sterner J. and Gavua K., 1988. Why pots are decorated. *Current Anthropology*, 29: 365-389.

Davidson I., 2002. The finished artefact fallacy: Acheulean hand-axes and language origins. In. Wray A. (ed), The Transition to Language. Oxford: Oxford University Press; pp. 180-203.

Degasperi N., 1999. I pozzetti neolitici. Una proposta metodologica e interpretativa. *Annali del Museo di Rovereto*, 15: 3-37.

Degasperi N., Ferrari A., Steffè G., 1998. L'insediamento neolitico di Lugo di Romagna. In

A. Pessina and G. Muscio (eds.), *Settemila anni fa, il primo pane. Ambienti e culture delle società neolitiche*. Catalogo mostra Museo Friuliano di Storia Naturale (dicembre 1998-maggio 1999). Udine: Comune di Udine; pp. 117-124.

De Stefani S., 1885. Sopra la scoperta di oggetti di alta antichità scavati a Rivoli Veronese: Notizie di Stefano De' Stefani Regio Ispettore agli scavi. In *Atti del Regio Istituto Veneto di Scienze, Lettere ed Arti*, t. III, s. IV.

Dibble H.L., 1997. Platform variability and flake morphology: a comparison of experimental and archaeological data and implications for interpreting prehistoric lithic technological strategies. *Lithic technology*, 22: 150-170.

Dibble H.L. and Pelcin A., 1995. The effect of hammer mass and velocity on flake mass. *JAS*, 22(3): 429-439.

Dibble H.L. and Whittaker J.C., 1981. New experimental evidence on the relation between percussion flaking and flake variation. *JAS*, 8: 283-296.

Dobres M.-A., 1995. Gender and prehistoric technology: on the social agency of technical strategies. *World archaeology*, 27 (1): 25-49.

Dobres M.-A., 1999. Technology's links and chaînes: the processual unfolding of technique and technician. In Dobres M.-A. and Hoffman C.R. (eds.), *The social dynamics of technology: practice, politics and world views*. Washington DC: Smithsonian Institution Press; pp. 124-146.

Dobres M.-A., 2000. *Technology and social agency*. Oxford: Blackwell.

Dobres M.-A. and Hoffman C.R., 1994. Social agency and the dynamics of prehistoric technology. *JAMT*, 1(3): 211-258.

Dobres M.-A. and Hoffman C.R., 1999a. Introduction: a context for the present and future of technology studies. In Dobres M.-A. and Hoffman C.R. (eds.), *The social dynamics of technology: practice, politics and world views*. Washington DC: Smithsonian Institution Press; pp. 1-19.

Dobres M.-A. and Hoffman C.R. (eds.), 1999b. *The social dynamics of technology: practice, politics and world views*. Washington DC: Smithsonian Institution Press.

Dobres M.-A. and Robb J. E., 2000. Agency in archaeology: paradigm or platitude? In Dobres M.-A. and Robb J. E.(eds.), *Agency in archaeology*. London: Routledge, pp. 3-18.

Donati P. and Carazzetti R., 1987. La stazione neolitica di Castel Grande in Bellinzona (Ticino, Svizzera). In *Atti della XXVI Riunione Scientifica dell'I.I.P.P.*, vol. 2; pp. 467-477.

Drygulski Wright B., 1987. Introduction. In Drygulski Wright B., Marx Ferree M. and Mellow G. et al. (eds.), *Women, work and technology: transformations*. Ann Arbor: University of Michigan Press; pp. 1-22.

Dunnell R.C., 1971. *Systematics in prehistory*. New York: the Free Press.

Edmonds M., 1990. Description, understanding and the chaîne opératoire. In Sinclair A. and Schlanger N. (eds.), *Technology in the Humanities*. *Archaeological Review from*

Cambridge, 9(1): 55-70.

Edmonds M., 1995. *Stone Tools and Society. Working Stone in Neolithic and Bronze Age Britain.* London: B.T. Batsford.

Edmonds M., Evans C. and Gibson D., 1999. Assembly and Collection - Lithic Complexes in the Cambridgeshire Fenlands. *PPS*, 65: 47-82.

Elkin P.A., 1948. Pressure flaking in the northern Kimberley, Australia. *Man*, 130: 110-113.

Elkin P.A., 1964. *The Australian Aborigines*. New York: Doubleday.

Ericson J.E., 1984. Toward the analysis of lithic production systems. In Ericson J.E. and Purdy B.A. (eds.), Prehistoric Quarries and Lithic Production. New directions in archaeology. Cambridge: CUP; pp. 1-10.

Fenu P., 2005. Contraguda (Sassari): assetti strutturali e fisionomie stilistiche delle industrie litiche dell'area 4. In Martini F. (ed.), *Askategi, miscellanea in memoria di Georges Laplace*. RSP, Supplemento 1. Firenze; pp. 489-508.

Fernandes P., 1981. Le Paléolithique de la région d'Aurillac: historique des re-cherches et travaux en cours. *Revue de la Haute-Auvergne Aurillac*, 83: 207-214.

Fernandes P. and Raynal J.P., 2006. Pétroarchéologie du silex: un retour aux sources. *Comptes Rendus Palevol*, 5: 829-837.

Fernandes P., Raynal J.P. and Moncel M.H., 2008. Middle Palaeolithic raw material gathering territories and human mobility in the southern Massif Central, France: first results from a petro-archaeological study on flint. *JAS*, 35: 2357-2370.

Ferrari A., Fontana F., Pessina A., Steffè G. and Visentini P., 1998. Provenienza e circolazione delle rocce silicee scheggiate fra Mesolitico e Età del Rame in Emilia centro orientale, Romagna e Friuli. *Archeologia dell'Emilia Romagna* II/1: 13-19.

Ferrari A., Delpino C., Petrucci G., Rottoli M. and Visentini P., 2002a. Introduzione al paleopopolamento dell'ultimo Neolitico dell'Italia padano-alpina e nordadriatica. In Ferrari A. and Visentini P. (eds.), *Il declino del mondo neolitico. Ricerche in Italia centro-settentrionale fra aspetti peninsulari, occidentali e nord-alpini.* Atti del Convegno (Pordenone 2001). Pordenone: Quaderni del Museo Archeologico del Friuli Occidentale, 4; pp. 101-122.

Ferrari A., Pessina A. and Steffè G., 2002b. Il primo Neolitico dell' Emilia centro-orientale e della Romagna. In *Atti della XXXIII Riunione Scientifica dell'I.I.P.P.* (Trento 1997). Firenze; pp. 363-375.

Ferrari A. and Mazzieri P., 1998. Fonti e processi di scambio di rocce silicee scheggiabili. In A. Pessina and G. Muscio (eds.), *Settemila anni fa, il primo pane. Ambienti e culture delle società neolitiche*. Catalogo mostra Museo Friuliano di Storia Naturale (dec. 1998 - may 1999). Udine: Comune di Udine; pp. 165-170.

Ferrari A., Steffé G., Fontana F. and Mazzieri P., 2006. Il comprensorio montano fra Paleolitico superiore ed età del Rame: il caso modenese. In Cardarelli A. and Malnati L. (eds.), *Atlante dei Beni Archeologici della provincia di Modena.* Vol. II, Montagna. Firenze:

All'Insegna del Giglio; pp. 17-39.

Finlayson B., Mithen S., Carruthers D., Kennedy A., Pirie A. and Tipping R., 2000. The Dana-Faynan-Ghuwayr Early Prehistory Project. *Levant*, 32: 1-26.

Forenbaher S. and Miracle P.T., 2005. The spread of farming in the Eastern Adriatic. *Antiquity*, 79 (305): 514-528.

Freeman L.G., 1978. The analysis of some occupation floors distributions from earlier and middle Paleolithic. In Freeman L.G. (ed.), *Views of the Past*. The Hague: Mouton; pp. 57-93.

Frison G.C., 1968. A functional analysis of certain chipped stone tools. *AA*, 33: 49-155.

Fullagar R.,1989. The potential of lithic use-wear and residue studies for determining stone tool functions. In Gorecki P.P and Gillieson D. (eds.), A Crack in the Spine: Prehistory and Ecology of the Jimi-Yuat Valley, Papua New Guinea. Townsville: James Cook University of North Queensland; pp. 209-223.

Gambari F.M., Venturino Gambari M. and D'Errico F., 1992. Alba e la neolitizzazione del Piemonte. *BPI*, 83: 31-124.

Gardin S., 2008. *Analisi tecnologica dell'industria litica proveniente dalla prima area di abitazione dell'insediamento neolitico di Molino Casarotto nelle Valli di Fimon (Colli Berici, Vicenza)*. Diss., Università di Ferrara.

Gardiner J., 1990. Flint procurement and Neolithic axe production on the South Downs: a re-assessment. *Oxford Journal of Archaeology*, 9: 119- 140.

Gardiner J., 2004. *Research Framework for Holocene Lithics in Britain*. London: Lithic Studies Society and English Heritage.

Garrow D., 2007. Placing pits: Landscape Occupation and Depositional Practice During the Neolithic in East Anglia. *PPS*, 73: 1-24.

Geneste J.-M., 1988. Systèmes d'approvisionnement en matiéres premiéres au paléolithiqye moyen et au paléolithique supeérieur d'Aquitaine. In Kozlowski J.K. (ed.), *L'Homme de Néandertal, vol. III. La mutation*. ERAUL No. 35. Liège: Université de Liège, pp. 61-70.

Gero J.M., 1978. Summary of experiments to duplicate post-excavational damage to tool edges. *Lithic Technology*, 7: 34-36.

Gero J.M., 1989. Assessing social information in material objects: how well do lithics measure up? In Torrence R. (ed.), *Time, Energy and Stone Tools*. New Directions in Archaeology. Cambridge: Cambridge Archaeological Press; pp. 92-105.

Gero J.M., 1991. Genderlithics: women's role in stone tools production. In Gero J.M. and Conkey M.W. (eds.), *Engendering archaeology: women and prehistory*. Oxford: Basil Blackwell, pp.: 163-193.

Gobert E.G., 1955. Les références historiques des nourritures tunisiennes.

Godelier M. and Garanger J., 1973. Outils de pierre, outils d'acier chez les Baruya de Nouvelle-

Guinée: quelques données ethnographiques et quantitatives. *L'Homme*, 13(3): 187-220.

Gosden C., 1994. *Social being and time*. Oxford: Blackwell.

Gosden C., 2001. Making sense: archaeology and aesthetics. *World Archaeology*, 33: 163-167.

Gosselain O. P., 1998. Social and technical identity in a clay crystal ball. In Stark M.T. (ed.), *The archaeology of social boundaries*. Washington D.C.: Smithsonian Institution Press; pp. 78-106.

Gossman L., 2003. Anecdote and History. *History and Theory*, 42: 143-168.

Gould R.A.,1980. *Living Archaeology*. Cambridge: CUP.

Gould R.A. and Saggers S., 1985. Lithic procurement in Central Australia: a closer look at Binford's idea of embeddedness in archaeology. *AA*, 50: 117-136.

Graves-Brown P.M., 1995a. Fearful symmetry. *World Archaeology*, 27: 88-99.

Graves-Brown P.M., 1995b. Stone tools, dead sheep, saws and urinals: a journey through art and skill. In Schofield A.J. (ed)., *Lithics in Context. Suggestions for the Future Direction of Lithic Studies*. Lithic Studies, Occasional Paper 5. London: Lithic Studies Society; pp. 9-17.

Green S.W. and Zvelebil M., 1990. The Mesolithic colonization and agricultural transition of South-east Ireland. *PPS*, 56: 57-88.

Griffiths D.R., Bergman C.A., Clayton C.J., Ohnuma K., Robins G.V. and Seeley N.J., 1987. Experimental investigation of the heat treatment of flint. In Sieveking G.G. and Newcomer M.H. (eds.), *The human use of flint and chert*. Cambridge: CUP; pp. 43-52.

Greene K., 2004. Archaeology and Technology. In Bintliff J. (ed.), *A Companion to Archaeology*. Malden/Oxford/Victoria: Blackwell; pp. 155-173.

Guidi A., 2000. *Preistoria della complessità sociale*. Rome: Laterza.

Guidi A. and Piperno M., 1992. Introduzione. In Guidi A. and Piperno M. (eds.), *Italia preistorica*. Roma: Laterza.

Guilaine J., 2000. De L'Orient à L'Occident: la Néolithisation de la Méditerranée. Questions ouvertes. In Pessina A. and Muscio G. (eds.), *La neolitizzazione tra Oriente e Occidente.* Atti del Convegno di Studi, Udine, 23-24 aprile 1999. Udine; pp. 11-21.

Guilbeau D., 2012. Le lame per pressione con una leva dell'Ozieri: la scelta della selce in questione. *Atti della XLIV Riunione scientifica: la preistoria e la protostoria della Sardegna: Sassari 23-28 novembre 2009*. Cagliari: Barumini; pp. 1063-1067.

Gurova M., 2008. Towards an understanding of Early Neolithic populations: a flint perspective from Bulgaria. *Documenta Praehistorica*, 35: 111-129.

Habicht-Mauch J.A., Eckert S.L. and Huntley D.L. (eds.), 2006. *The Social Life of Pots*. Tucson: University of Arizona Press.

Halperin R.H., 1994. *Cultural economies past and present*. Austin: University of Texas Press.

Haudricourt A.-G., 1964. La technologie, science humaine. *La Pensée*, 115: 28-35.

Hayden B., 1995. The emergence of prestige technologies and pottery. In Barnett W. and Hoopes J. (eds.), *The emergence of pottery production: technology and innovation in ancient societies*. Washington DC: Smithsonian Institution Press; pp. 257-265.

Hayden B., 1998. Practical and prestige technology: the evolution of material systems. *JAMT*, 5 (1): 1-55.

Hayden B. and Cannon A., 1983. Where the garbage goes: refuse disposal in the Maya Highlands. *Journal of Anthropological Archaeology*, 2: 117-118.

Hayden B., Franco N. and Spafford J., 1996. Evaluating Lithic Strategies and Design Criteria. In Odell G.H. (ed.), *Stone Tools, Theoretical Insights into Human Prehistory*. New York and London: Plenum Press; pp. 9-45.

Hayden B. and Hutchings W.K., 1989. Whither the billet flake. In Amick D. and Mauldin R. (eds.), *Experiments in lithic technology*. BAR British Series 528. Oxford; pp. 235-258

Hegmon M., 1992. Archaeological research on style. *Annual Review of Anthropology*, 21: 517-537.

Henry D.O., 1989. Correlations Between Reduction Strategies and Settlement Patterns. In Henry D.O. and Odell G.H. (eds.), *Alternative Approaches to Lithic Analysis*. Boulder, Colorado: Westview Press; pp. 139-212.

Hermon S. and Niccolucci F., 2002. Estimating subjectivity of typologists and typological classification with fuzzy logic. In Djindjian F. and Moscati P. (eds.), *XIV UISPP Congress (Liège-Belgium 2001). Proceedings of Commission IV: Data Management and Mathematical Methods in Archaeology*. Archeologia e Calcolatori vol.13; pp. 217-232.

Hill J.D., 1995. *Ritual and Rubbish in the Iron Age of Wessex: a study of the formation of a specific archaeological record*. BAR British Series 242. Oxford: Tempus Reparatum.

Hiscock P., 2004. Slippery and Billy: intention, selection and equifinality in lithi artefacts. Cambridge *Archaeological Journal*, 14: 71-77.

Hodder I., 1982a. *Symbols in action. Ethnoarchaeological studies of material culture*. Cambridge CUP.

Hodder I., 1982b. *The Present Past. An introduction to anthropology for archaeologists*. London: Batsford.

Hodder I., 1986. *Reading the past*. Cambridge: CUP.

Hodder I., 1990. Technology in the humanities: a commentary. In Sinclair A. and Schlanger N. (eds.), *Technology in the humanities*. Archaeological Review from Cambridge 9(1): 154-157.

Hoffman, C.R. 1999 Intentional damage as technological agency: breaking metals in Late Prehistoric Mallorca, Spain. In Dobres M.-A. and Hoffman C.R. (eds.), *The social dynamics of technology: practice, politics, and world views*. Washington D.C.: Smithsonian Institution Press, pp. 103-123.

Hudson P. and La Rocca-Hudson C., 1982. *Rocca di Rivoli. Storia di una collina nella valle dell'Adige tra Preistoria e Medioevo*. San Giovanni Lupatoto (Verona).

Hurcombe L., 2014. *Archaeological Artefacts as Material Culture*. London: Routledge.

Ingold T., 1988. Tools, minds and machines: an excursion in the philosophy of technology. *Techniques et Cutlure*, 12: 151-176.

Ingold T., 1990. Society, Nature and the concept of technology. *Archaeological Review from Cambridge*, 9(1): 5-17.

Ingold T., 1993. Relations between visual-gestural and vocal-auditory modalities of communication. In Gibson K.R. and Ingold T. (eds.), *Tools, Language and Cognition in Human Evolution*. Cambridge: CUP; pp. 35-42.

Ingold T., 1999. Foreword. In Dobres M.-A. and Hoffman C.R. (eds.), *The social dynamics of technology: practice, politics, and world views*. Washington D.C.: Smithsonian Institution Press; pp. ix-xii.

Ingold T., 2000. *The Perception of the environment. Essays in livelihood, dwelling and skill*. London/New York: Routledge.

Inizan M.L., Roche H. and Tixier J., 1976. Avantages d'un traitment thermique pour la taille des roches siliceuses. *Quaternaria*, 19: 1-18.

Inizan M.L., Reduron-Ballinger M., Roche H., Tixier J., 1999. *Technology and Terminology of Knapped Stone*. Nanterre: CREP.

Isotta C. e Zanini C., 2008. La selce dei Monti Lessini. *La Lessinia, Ieri Oggi e Domani*, 31: 65-72.

Jeske R.J., 1989. Economies in raw material use by prehistoric hunter-gatherers. In Torrence R. (ed.), *Time, Energy and Stone Tools*. New Directions in Archaeology Series. Cambridge: CUP; pp. 34-45.

Jeter M.D., 1980. Analysis of flaked stone artifacts and debitage. In Doyel D.E. and Debowski S.S. (eds.), *Prehistory in Dead Valley, east-central Arizona: the TG&E Springerville Report*. Tucson: Arizona State Museum Archaeological Series No. 144; pp. 235-304.

Johnson J.K., 1989. The utility of production trajectory modeling as a framework for regional analysis. *Archeological Papers of the American Anthropological Association*, 1(1): 119-138.

Johnson J.K., 1996. Lithic analysis and questions of cultural complexity. The Maya. In Odell G.H. (ed.), *Stone Tools. Theoretical Insights into Human Prehistory*. New York/London: Plenum Press; pp. 159-179.

Jones S., 1996. Discourses of identity in the interpretation of the past. In Graves-Brown P., Jones S. and Gamble C. (eds.), *Cultural Identity and Archaeolgy: the construction of European communities*. London: Routledge; pp. 62-80.

Juel Jensen H., 1989. Plant harvesting and processing with flint implements in the Danish Stone Age. *Acta Archaeologica*, 59: 131-142.

Juel Jensen H., 1994. *Flint tools and Plant working. Hidden traces of stone age technology. A use wear study of some Danish Mesolithic and TRB implements*. Aarhus University Press.

Karlin C., 1972. Le débitage. In Leroi-Gourhan A. and Brézillon M. (eds.), *Les fouilles de Pincevent. Essai d'analyse ethnographique d'un habitat magdalénien*. VIIe supplément à Gallia-Préhistoire- Paris: éditions du C.N.R.S., pp. 263-277.

Karlin C. and Julien M., 1994. Prehistoric technology: a cognitive science? In Renfrew C. and Zubrow E. (eds.), *The ancient mind. Elements of cognitive archaeology*. New Directions in Archaeology. Cambridge: CUP; pp. 152-164.

Keeley L.H., 1980. *Experimental determination of stone tool uses: a microwear analysis*. Chicago: University of Chicago Press.

Keeley L.H., 1982. Hafting and retooling: effects on the archaeological record. *AA*, 47: 798-809.

Kelly R.L., 1988. The three sides of a biface. *AA*, 53: 717-734.

Kelly R.L., 1992. Mobility/sedentism: concepts, archaeological measures and effects. *Annual Review of Anthropology*, 21: 43-66.

Klie B.J, Bernard M.C., Simmons A.H. and Olszewski D.L., 1982. Stone Artifact Glossary. In Jefferson Reid J. (ed.), *Cholla Project Archaeology, vol. 2: The Chevelon Region*. Tucson: Arizona State Museum Archaeological Series No. 161; pp. 219-221.

Kooyman B.P., 2000. *Understanding stone tools and archaeological sites*. Albuquerque: UNM Press.

Königer J. and Schlichterle H., 2001. Foreign elements in South-West German lake-dwellings: transalpine relations in the Late Neolithic and Early Bronze Ages. *PA*, 35: 43-53.

Kuhn S.L., 1991. Unpacking reduction: lithic raw material economy in the Mousterian of West-Central Italy. *Journal of Anthropological Archaeology*, 10: 76-106.

Kuhn S.L., 1995. *Mousterian Lithic Technology: An Ecological Perspective*. Princeton: Princeton University Press.

Laplace G., 1964. Essay de typologie sistematique. *AF* (sez. XV), 11: 1-82.

Lave J. and Wenger E., 1991. *Situated Learning. Legitimate Peripheral Participation*. Cambridge: CUP.

Laviosa Zambotti P., 1938. *Le civiltà preistoriche e protostoriche nell'Alto Adige.* Milan.

Laviosa Zambotti P., 1940. La ceramica della Lagozza e la civiltà palafitticola italiana vista nei suoi rapporti con le civiltà mediterranee ed europee. *BPI*, 59: 83-164.

Léa V., 2004. *Les industries lithiques du Chaséen en Languedoc oriental*. BAR IS 1232. Oxford.

Léa V., 2005. Raw, pre-heated or ready to use: discovering specialist supply systems for flint industries in mid-Neolithic (Chassey culture) communities in southern France. *Antiquity*, 79: 1-15.

Lechtman H., 1977. Style in technology: some early thoughts. In Lechtman H. and Merrill R.S. (eds.), Material Culture: Styles, Organization and Dynamics of Technology. St. Paul, Minnesota: American Ethnological Society; pp. 3-20.

Lemonnier P., 1983. L'étude des systemés techniques, une urgence en tecnologie culturelle. *Techniques et cultures* (n.s.), 1: 11-26.

Lemonnier P., 1986. The study of material culture today: towards an anthropology of technical systems. *Journal of Anthropological Archaeology*, 5: 147-186.

Lemonnier P., 1989. Bark capes, arrow- heads and Concorde: on social representations of technology. In Hodder I. (ed.), *The Meaning of Things. Material Culture and Symbolic Expression*. London: Routledge; pp. 156-171.

Lemonnier P., 1990. Topsy turvy techniques: remarks on the social representation of techniques. *Archaeological Review from Cambridge*, 9 (1): 27-37.

Lemonnier P., 1992. *Elements for an anthropology of technology*. Anthropological Papers, No. 88. Museum of Anthropology. Ann Arbor: University of Michigan Press.

Lemonnier P., 1993. Introduction. In Lemonnier P. (ed.), *Technological Choices. Transformation in Material Cultures since the Neolithic*. London/New York: Routledge; pp. 1-35.

Lemonnier P., 2004. Mythiques chaînes opératoires. *Techniques et Cultures*, 43-44: 2-13.

Leroi-Gourhan A., 1943. *Evolution et techniques 1 - L'Homme et la matière*. Paris: Albin Michel.

Leroi-Gourhan A., 1945. *Evolution et techniques 2 - Milieu et techniques.* Paris: Albin Michel.

Leroi-Gourhan A., 1960. L'illusion technologique. In *La technique e l'homme. coll. Recherches et débats.* Paris: Fayard, pp. 65-74.

Leroi-Gourhan A., 1964. *Le geste et la parole 1 - Technique et langage*. Paris: Albin Michel.

Leroi-Gourhan A., 1965. *Le geste et la parole 2 - La mémoire et les rythmes.* Paris: Albin Michel.

Leroi-Gourhan A. and Brezillon M., 1966. L'habitation magdalénienne n. 1 de Pincevent, prés Monterau (Seine-et-Marne). *Gallia Préhistoire*, 9 (2): 263-385.

Lindgren C., 2003. My way or your way. On the social dimension of technology as seen in lithic strategies in eastern middle Sweden during the Mesolithic. In Larson L. (ed.), *Mesolithic on the Move*. Papers Presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000. Oxford: Oxbow Books; pp. 177-183.

Liseno M.G., Mazzieri P. and Mutti A., 2002. L'abitato eneolitico di Benefizio (Parma). *Acta Naturalia Ateneo Parmense*, 38(4): 165-178

Loney H.L., 2000. Society and technological control: a critical review of models of technological change in ceramic studies. *AA*, 65: 646-668.

Longo L., 1994. L'industria litica. L'analisi delle tracce d'uso. In Peretto C. (ed.), *Le industrie litiche del giacimento paleolitico di Isernia La Pineta. La tipologia, le tracce di utilizzazione, la sperimentazione*. Campobasso: Monografia IRESMO, pp. 355-466.

Longo L. et al., 2004. La selce: disponibilità, caratterizzazione e importanza economica per le strategie insediative preistoriche nel territorio veronese. *Bollettino del Museo di Storia Naturale di Verona*, 28: 77-90.

Longo L., Iovino M.R. and Lemorini C., 2000-2001. L'analisi funzionale per lo studio delle industrie litiche. Con un'appendice sull'analisi funzionale delle materie dure animali. *RSP*, LI: 389-454.

Longo L., Peretto C., Sozzi M., Vannucci S., 1997. Artefacts Outils ou Supports épuises? Une nouvelle approche pour l'études des industries du Paléolithique ancien: le cas d'Isernia La Pineta (Molise, Italie Centrale). *L'Anthropologie*, 101(4): 579-596.

Longo L. and Zanini C. 2004., (with contributions by Candelato F., Castagna A., Isotta L.C., Martinelli N., Parenti F., Peloso D., Rigoni A. e Rioda V.), 2004. Archeologia di un territorio. In Latella L. (ed.), *Il Monte Pastello*. Verona: MMCSN (II serie) & Comune di Verona; pp. 311-334.

Lunardi A., 2008. Analisi tecno-funzionale degli strumenti in pietra non scheggiata per una ricostruzione del contesto economico della cultura dei vasi a bocca quadrata: i siti di Fimon-Molino Casarotto, Quinzano e Rivoli-Rocca (Veneto). *Padusa*, 44: 1000-1037.

Maggi R. (ed.), 1997. *Arene Candide: A Functional and Environmental Assessment of the Holocene Sequence (Excavations Bernabò Brea-Cardini, 1940-50).* Memorie dell'Istituto Italiano di Paleontologia Umana, no. 5. Rome: Ministero per i Beni Culturali e Ambientali.

Magne M. and Pokotylo D., 1981. A pilot study in bifacial lithic reduction sequences. *Lithic Technology*, 10: 34-47.

Malavolti F., 1951-1952. Appunti per una cronologia relativa del neo-eneolitico emiliano. *Emilia Preromana*, III: 3-28.

Malavolti F., 1953-1955. Appunti per una cronologia relative del neo-eneolitico emilicano. *Emilia Preromana*, IV: 5-43.

Malone C., 2003. The Italian Neolithic: a synthesis of research. *Journal of World Prehistory*, 17(3): 235-312.

Man E.H., 1883. On the aboriginal inhabitants of the Andaman Islands. *Journal of the Royal Anthropological Institute of Great Britain and Ireland*, 12: 371-391.

Marshall G., 2000. The distribution and character of flint beach pebbles on Islay as a source for Mesolithic chipped stone artefact production. In Mithen S. (ed.), *Hunter-Gatherer Landscape Archaeology. The Southern Hebrides Mesolithic Project 1988-98*. Cambridge: McDonald Institute for Archaeological Research; 79-90.

Massi Pasi M. and Prati L., 1988. Vecchiazzano (Forlì). Relazione preliminare di scavo. In Prati L. and Antoniazzi A. (eds.), *Flumen Aquaeductus. Nuove scoperte archeologiche dagli scavi per l'acquedotto della Romagna*. Bologna: Nuova Alfa; pp. 135-147.

Massi Pasi M., Prati L. and Mengoli L., 1996. Il sito neolitico di Vecchiazzano (Forlì). In Bermond Montanari G., Massi Pasi M. and Prati L. (eds.), *Quando Forlì non c'era. Origine del territorio e popolamento umano dal Paleolitico al IV sec. a.C.* (Catalogo della mostra). Forlì: A.B.A.C.O. & Comune di Forlì; pp. 131-142.

Mauldin R.P. and Amick D.S., 1989. Investigating patterning in debitage from experimental bifacial core reduction. In Amick D.S. and Mauldin R.P. (eds.), *Experiments in Lithic Technology*. BAR IS 528. Oxford; pp. 67-88.

Mauss M., 1927. Note de méthode sur l'extension de la sociologie. Reprinted in Mauss M., 1969, *Œuvres*, vol. 3: 283-297.

Mauss M., 1936. Techniques du corps. *Journal de psychologie normal et patholigique*, XXXII: 271-293. Reprinted in Mauss M., 1968. *Sociologie et Anthropologie* (with introduction by Claude Levi-Strauss), 4th edition. Paris: Presses Universitaires de France; pp. 364-386.

Mauss M., 1947. *Manuel d'ethnographie*. Paris: Editions Payot & Rivages.

Mazzieri P. and Dal Santo N., 2007. Il sito del Neolitico recente di Botteghino (Parma). *RSP*, LVII: 113-138.

McBrearty S.,1990. Consider the humble termite: termites as agents of post-depositional disturbance at African archaeological sites. *JAS*, 17(2): 111-143.

McBrearty S., Bishop L., Plummer T., Dewar R. and Conard N., 1998. Tools underfoot: human trampling as an agent of lithic artifact edge modification. *AA*, 63: 108-129.

McBryde I., 1984. Kulin greenstone quarries: the social contexts of production and distribution for the Mt. William site. *World Archaeology*, 16: 267-285.

McPherron S.P., Alemseged Z., Marean C.W., Wynn J.G., Reed D., Geraads D., Bobe R. and Bearat H.A., 2010. Evidence for stone-tool-assisted consumption of animal tissues before 3.39 million years ago at Dikika, Ethiopia. *Nature*, 466 (7308): 857-860.

Milne S.B., 2005 Palaeo-Eskimo Novice Flintknapping in the Eastern Canadian Arctic. *Journal of Field Archaeology*, 30: 329-345

Minar C.J. and Crown P.L., 2001. Learning and Craft Production: An Introduction. *Journal of Anthropological Research*, 57: 369-80.

Mitcham C., 1994. *Thinking through technology: the path between engineering and philosophy*. Chicago: University of Chicago Press.

Mobley C.M., 1982. The Landmark Gap Trail Site, Tangle Lakes, Alaska: Another Perspective on the Amphitheater Mountain Complex. *Arctic Anthropology*, 19: 81-102.

Moroni Lanfredini A., 2005. L'industria litica di Grotta del Lago (Cerreto di Spoleto, Perugia) nel quadro dei complessi del Neolitico recente dell'Italia centrale. *RSP*, 55(Supplemento 1), 471-488.

Mortensen P., 1970. A preliminart study of the chipped stone industry from Beidha. *Acta Archaeologica*, 41: 1-54.

Moore H.,1982. The interpretation of spatial patterning in settlement residues. In Hodder,I. (ed.), *Symbolic and structural archaeology*. Cambridge: CUP; pp. 74-79.

Moser L. and Pedrotti A., 1996. L 'abitato neolitico di Lugo di Grezzana (Verona): relazione preliminare. In Belluzzo G. and Salzani N. (eds.), *Dalla terra al museo*. Legnago; pp. 23-33.

Mottes E., 2001. Peninsular cultural interferences in the Square Mouthed Pottery Culture of Trentino. In *Atti della XXXIII Riunione Scientifica dell' I.I.P.P.*, *Trento 1997*; pp. 63-67.

Mottes E., 2002. Scambio e circolazione della selce sudalpina nei territory a nord delle Alpi in età preistorica. In Attraverso le Alpi. Uomini, vie, scambi nell'antichità. Archäologischen. Landesmuseum Baden-Württemberg, Almanach 7/8. Stuttgart: Konrad Teiss Verlag; pp. 95-105.

Nash S.E., 1996. Is curation a useful heuristic? In Odell G.H. (ed.), *Stone Tools. Theoretical Insights into Human Prehistory*. New York: Plenum Press; pp. 81-99.

Nassaney M.S., 1996. The role of chipped stone in the political economy of social ranking. In Odell G.H. (ed.), *Stone Tools. Theoretical Insights into Human Prehistory*. New York: Plenum Press; pp.181-224.

Nelson M.C., 1991. The study of technological organization. *JAMT*, 3: 57-100.

Neumann T.W. ad Johnson E.H., 1979. Patrow site lithic analysis. *Mid-continental Journal of Archaeology*, 4: 79-111.

Newcomer M.H., 1971. Some quantitative experiments in handaxe manufacture. *World Archaeology*, 3: 84-93.

Newcomer M.H., 1975. Punch technique and Upper Paleolithic blades. In Swason E.H.(ed.), *Lithic technology: making and using stone tools*. Berlin: Walter de Gruyter; pp. 97-102.

Newman J.R., 1994. The effects of distance on lithic material reduction technology. *Journal of Field Archaeology*, 21: 491-501.

Nielsen A.E., 1991. Trampling the archaeological record: an experimental study. *AA*, 56: 483-503.

Nishiaki Y., 2000. *Lithic Technology of Neolithic Syria*. BAR IS, No. 840. Oxford.

Noble W. and Davidson I., 1996. *Human Evolution, Language and Mind. A Psychological and Archaeological Enquiry*. Cambridge: CUP.

O'Connell J.F., 1977. Aspects of Variation in Central Australian Lithic Assemblages. In Wright R.V.S. (ed.), *Stone Tools as Cultural Markers: Change, Evolution and Complexity*. Canberra: Australian Institute of Aboriginal Studies; pp. 269-281.

Odell G.H., 1989. Experiments in lithic reduction. In Amick D.S. and Mauldin R.P. (eds.), *Experiments in Lithic Technology*. BAR IS 528. Oxford; pp. 163-198.

Odell G.H., 1994. Prehistoric hafting and mobility in North American midcontinent: examples from Illinois. *Journal of Anthropological Archaeology*, 13: 51-73.

Odell G.H., 1996. Economizing behavior and the concept of 'curation'. In Odell G.H. (ed.), *Stone tools. Theoretical Insights into Human Prehistory*. New York: Plenum Press; pp. 51-80.

Odell G.H., 2001. Stone Tool Research at the End of the Millennium: Classification, Function, and Behavior. *Journal of Archaeological Research*, 9: 45-100.

Odell G.H. and Odell-Vereecken F., 1980. Verifying the reliability of lithic use-wear assessments by “blind tests”: the low power approach. *Journal of Field Archaeology*, 7: 87-120.

Ohnuma K., 1988. *Ksar Akil, Lebanon. A technological study of the earlier Upper Palaeolithic levels of Ksar Akil*. Vol. III Levels XXV-XIV. BAR IS 426. Oxford.

Ohnuma K. and Bergman C.A., 1982. Experimental studies in the determination of flaking mode. *Bulletin of the Institute of Archaeology*, 19: 161-170.

Olausson D.S. and Larsson L., 1982. Testing for the presence of thermal pre-treatment of flint in the Mesolithic and Neolithic of Sweden. *JAS*, 9: 275-286.

Palma di Cesnola A.,1962. Contributi alla conoscenza delle industrie epigravettiane nell’Italia centro-meridionale. *RSP*, XVII (1-4):1-75.

Pearce M., 2000. What this awl means: understanding the earliest Italian metal work. In Ridgway D., Serra Ridgway F.R., Pearce M., Herring E., Whitehouse R. and Wilkins J. (eds.), *Ancient Italy in its Mediterranean setting. Studies in honour of Ellen Macnamara.* Accordia Specialist Studies on the Mediterranean 4. London: Accordia Research Institute, University of London; pp. 67-73.

Pearce M., 2008. Structured deposition in Early Neolithic northern Italy. *Journal of Mediterranean Archaeology*, 21: 19-33.

Pearce M., 2013. *Rethinking the North Italian Early Neolithic*. London: Accordia Research Institute.

Pearce M., 2015. The spread of early copper mining and metallurgy in Europe: an assessment of the diffusionist model. In Hauptmann A. and Modaressi-Teherani D. (eds.), *Archaeometallurgy in Europe III. Proceedings of the 3rd International Conference; Bochum, June 29 - July 1, 2011*. Bochum: Deutsches Bergbau Museum.

Pedrotti A., 1990a. L’insediamento di Kanzianiberg: rapporti culturali tra Carinzia ed Italia settentrionale nel Neolitico. In P. Biagi (ed.), *The Neolithisation of the Alpine Region*. Monografie di Natura Bresciana, 13. Brescia; pp. 213-226.

Pedrotti A., 1990b. L’abitato neolitico de “La Vela” di Trento. In *Die ersten Bauern, 2*. Zürich: Schweizerisches Landesmuseum; pp. 219-224.

Pedrotti A., 1996. Un insediamento d’altura alla Torretta di Isera. In Tecchiati U. (ed.), *Dalle radici della storia. Archeologia del Comun Comunale Lagarino: storia e forme dell’insediamento dalla preistoria al Medio Evo*. Rovereto: Museo Civico di Rovereto, Comune di Villa Lagarina; pp. 71-86.

Pedrotti A., 2000. Neolitico Antico. In Aspes A. (ed.), *Preistoria Veronese. Contributi e aggiornamenti*. Verona; Museo Civico di Storia Naturale, pp. 59-65.

Pedrotti A., 2001. Il Neolitico. In Lanziger M., Marzatico F. and Pedrotti A. (eds.), *Storia del Trentino. La preistoria e la protostoria*. Bologna: il Mulino; pp. 119-181.

Pedrotti A. and Salzani P., 2010. Lugo di Grezzana: un “emporio” di settemila anni fa sui Monti Lessini veronesi. *La Lessinia, Ieri oggi domani*, 33: 87-104.

Pelcin A.W., 1997a. The effect of core surface morphology on flake attributes: evidence from a controlled experiment. *JAS*, 24: 749-756.

Pelcin A.W., 1997b. The formation of flakes: the role of platform thickness and exterior platform angle in the production of flake initiations and terminations.*JAS*, 24: 1107-1113.

Pelegrin J., 1990. Prehistoric lithic technology: some aspects of research. In Sinclair A. and Schlanger N. (eds.), *Technology in the humanities*. Archaeological Review from Cambridge 9(1): 116-125.

Pelegrin J., 1995. *Technologie lithique: le Châtelperronien de Roc-de-Combe (Lot) et de la Côte (Dordogne)*. Cahiers du Quaternaire, 20. Paris: CNRS editions.

Pelegrin J., Karlin C. and Bodu P., 1988. Chaînes opératoires: un outil pour le préhistorien. In Tixier J. (ed.), Technologie préhistorique. Notes et Monographies Techniques, 25. Paris: CNRS editions; pp. 55-62.

Pellegrini G., 1875. *Officina preistorica a Rivole Veronese*. Verona: Tipografia G. Franchini.

Perlès C. 1980 Économie de la matière première et économie du débitage : deux exemples grecs. In *Préhistoire et Technologie lithique*, 11-13 mai 1979. Centre de Recherche Archéologique du CNRS, publications de l'URA 28: cahiers n° 1, Centre régional de publication de Sophia Antipolis; pp. 37-41.

Perlès C., 1987. *Les industries lithiques taillées de Franchthi (Argolide, Grèce), Tome I. Présentation générale et industries paléolithiques. Excavations at Franchthi Cave*. Bloomington and Indianapolis: Indiana University Press.

Perlès C. 1991 Économie des matière premières et économie du débitage : deux conceptions opposées ? In *25 ans d'études technologiques en préhistoire: Bilan et perspectives*. Actes des XIe rencontres internationales d'Archéologie et d'Histoire d'Antibes, 18-20 octobre 1990, Juan-les-Pins : Ed. APDCA; pp. 35-46.

Perlès C., 1992a. Systems of exchange and organization of production in Neolithic Greece. *Journal of Mediterranean Archaeology*, 5: 115-164.

Perlès C., 1992b. In search of lithic strategies. A cognitive approach to prehistoric chipped stone assemblages. In Gardin J.C. and Peebles C. (eds.), *Representations in Archaeology*. Bloomington: Indiana University Press; pp. 223-247.

Perlès C., 1999. Long-term perspectives on the occupation of the Franchthi Cave: continuity and discontinuity. In Bailey G.N., Adam E., Panagopoulou E., Perlès C. and Zachos K. (eds.), *The Palaeolithic Archaeology of Greece and Adjacent Areas*. Proceedings of the ICOPAG Conference, Ioannina, September 1994, no. 3. Athens: British School at Athens Studies; pp. 311-318.

Perlès C., 2001. *The early Neolithic in Greece. The first farming communities in Europe*. Cambridge: CUP.

Perrin T., 2001. *Evolution du silex taillè dans le Nèolithique haut-rhodanien autour de la stratigraphies du Gardon (Ambérieu-en-Bugey, Ain)*. Thése de doctorat, Universitè de Paris I Panthéon-Sorbonne. Unpublished.

Perrin T., 2004. Les processus de néolithisation en Italie septentrionale. *Bulletin de la Société préhistorique française*, 101(4): 887-891.

Pessina A., 1998. Aspetti culturali e problematiche del primo Neolitico dell' Italia settentrionale. In Pessina A. and Muscio G. (eds.), *Settemila anni fa, il primo pane. Ambienti e culture delle società neolitiche*. Catalogo mostra Museo Friuliano di Storia Naturale (dicembre 1998-maggio 1999). Udine: Comune di Udine; pp. 95-106.

Pessina A., Ferrari A. and Fontana A., 1998. Le prime popolazioni agricole del Friuli. In Pessina A. and Muscio G. (eds.), *Settemila anni fa, il primo pane. Ambienti e culture delle società neolitiche*. Catalogo mostra Museo Friuliano di Storia Naturale (dicembre 1998-maggio 1999). Udine: Comune di Udine; pp. 133-146.

Pessina A. and Tinè V., 2008. *Archeologia del Neolitico. L'Italia tra VI e IV millennio a.C.* Roma: Carocci.

Peterson J., Mitchell D. and Shackley M.S., 1997. The social and economic contexts of lithic procurement: obsidian from classic-period Hohokam sites. *AA*, 62: 231-259.

Petrequin A.M. and Petrequin P., 1988. *Le Néolithique des lacs*. Paris: Errance.

Pfaffenberger B., 1988. Fetishised objects and humanised nature: towards an anthropology of technology. *Man* (n.s.) 23: 236-252.

Pfaffenberger B., 1992. Social anthropology of technology. *Annual Review of Anthropology*, 21: 491-516.

Pfaffenberger B., 1999. Worlds in the making: technological activities and the construction of intersubjective meaning. In Dobres M.- A. and Hoffman C. R. (eds.), *The social dynamics of technology: practice, politics, and world views*. Washington D.C.: Smithsonian Institution Press; pp. 147-164.

Pigeot N., 1990. Technical and social actors. Flintknapping specialists and apprentices at Magdalenian Etiolles. In Sinclair A. and Schlanger N. (eds.), Technology in the humanities. *Archaeological Review from Cambridge*, 9(1): 126-141.

Pistoia A.R., 2005. L'industria litica scheggiata del villaggio neolitico a Ceramica Impressa di Colle Santo Stefano (Ortucchio, L'Aquila). Scavi 1988-1993. In Martini F. (ed.), *Askategi, miscellanea in memoria di Georges Laplace*. RSP, Supplemento 1; pp. 343-369.

Pitt-Rivers A. H. L. F., 1875. The evolution of culture. In Meyer J (ed.), *The evolution of culture and other essays*. Oxford: Clarendon Press; pp. 20-44.

Pollard J., 2001. The aesthetics of depositional practice. *World Archaeology*, 33: 315-333.

Powell J.W., 1884. *Wandering in a Wild Country*. London.

Purdy B.A. and Brooks H.K., 1971. Thermal alteration of silica minerals: an archaeological approach. *Science*, 173: 322-325.

Raab L.M., Cande R.F. and Stahle D.W., 1979. Debitage graphs and archaic settlement patterns in the Arkansas Ozarks. *Mid-continental Journal of Archaeology*, 4: 167-182.

Radmilli A.M., 1967. *I villaggi a capanne del neolitico italiano*. Firenze: La Nuova Italia.

Rebitsch W., 1988. Der Raum Brixlegg in der Frühgeschichte und in der Römerzeit. In Landmann S. (ed.), *Brixlegg, eine Tiroler Gemeinde in Wandel der Zeit*. Brixlegg; pp. 99-105.

Reimer P.J., Bard E., Bayliss A., Beck J.W., Blackwell P.G., Bronk Ramsey C., Buck C.E., Cheng H., Edwards R.L., Friedrich M., Grootes P.M., Guilderson T.P., Haflidason H., Hajdas I., Hatté C., Heaton T.J., Hoffmann D.L., Hogg A.G., Hughen K.A., Kaiser K.F., Kromer B., Manning S.W., Niu M., Reimer R.W., Richards D.A., Scott E.M., Southon J.R., Staff R.A., Turney C.S.M., van der Plicht J., 2013. IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0-50,000 Years cal BP. *Radiocarbon*, 55(4): 1869-1887.

Renfrew C. and Zubrow E.B.W. (eds.), 1994. *The Ancient Mind: Elements of Cognitive Archaeology*. Cambridge: CUP.

Reynolds P. C., 1993. The complementation theory of language and tool use. In Gibson K. R. and Ingold T. (eds.), *Tools, language and cognition in human evolution*. Cambridge: CUP; pp. 407-428.

Richards C. and Thomas J., 1984. Ritual activity andstructured deposition in later Neolithic Wessex. In Bradley R. and Gardiner J. (eds.), *Neolithic Studies: a review of some recent work*. BAR British Series 133. Oxford; pp. 189-218.

Ricklis R.A. and Cox K.A., 1993. Examining lithic technological organization as a dynamic cultural subsystem: the advantages of an explicitly spatial approach. *AA*, 58: 444-461.

Rioda V., 2010. Caratteri geologici e paleoambientali del territorio rivolese. In Dalla Riva M. (ed.), *Alle Orgini del Territorio di Rivoli. Atti della Giornata di Studi, Rivoli Veronese 17 Maggio 2008*. Verona: Redaprint; pp. 13-18.

Robb J.E., 1998. The archaeology of symbols. *Annual Review of Anthropology*, 27: 329-346.

Robb J.E., 2008. Tradition and agency: human body representations in later prehistoric Europe. *World Archaeology*, 40(3): 332-353.

Robinson T.R., 1938. A survival of flake technique in southern Rhodesia. *Man*, 38: 224.

Roche H. and Tixier J., 1982. Les accidents de taille. In *Tailler! Pourquoi faire: Préhistoire et technologie lithique II, Recent Progress in Microwear Studies*. Leuven: Studia Praehistorica Belgica; pp. 65-76.

Rolland N. and Dibble H.L., 1990. A new synthesis of Middle Palaeolithic variability. *AA*, 55: 480-499.

Rosen S.A., 1996. The decline and fall of flint. In Odell G.H. (ed.), *Stone Tools. Theoretical Insights into Human Prehistory*. New York: Plenum Press; pp. 129-158.

Rosen S.A., 1997. *Lithics after the Stone Age: a Handbook of Stone Tools from the Levant*. London: Altamira Press.

Roux V., 1990. The psychological analysis of technical activities: a contribution to the study of craft specialisation. In Sinclair A. and Schlanger N. (eds.),Technology in the Humanities. *Archaeological Review from Cambridge* 9(1): 142-153.

Rozen K.C. and Sullivan A.P., 1989. The Nature of Lithic Reduction and Lithic Analysis: Stage Typologies Revisited. *AA*, 54(1): 179-184.

Runnels C., 1994. Tinderflints and firemaking in the historical period. *Lithic Technology*, 19 (1): 7-16.

Sackett J.R., 1982. Approaches to style in lithic archaeology. *Journal of Anthropological Archaeology*, 1: 59-112.

Sackett J.R., 1990. Style and ethnicity in archaeology: the case for isochrestism. In Conkey M.W. and Hastorf C. (eds.), *The uses of style in archaeology*. Cambridge: CUP; pp. 32-43.

Salzani P., 2002a. L'abitato del Neolitico recente di Gazzo Veronese - Località Scolo Gelmina. In Aspes A. (ed.), *Preistoria veronese. Contributi e aggiornamenti*. Verona: MMCSN (II Serie), Sezione di Scienze dell'Uomo, 5; p. 80-81.

Salzani P., 2002b. Il sito Neolitico recente di Gazzo Veronese - Località Scolo Gelmina. In Ferrari A. and Visentini P. (eds.), Il declino del mondo neolitico. Ricerche in Italia centro-settentrionale fra aspetti peninsulari, occidental e nord alpine. Atti del Convegno (Pordenone 2001). Pordenone: Quaderni del Museo Civico Archeologico del Friuli; pp. 515-520. .

Salzani P., 2002c. Il sito Neolitico recente di Gazzo Veronese - Località Ponte Nuovo. Due pozzetti della Cultura dei vasi a bocca quadrata di "stile meandrospiralico". In Aspes A. (ed.), *Preistoria veronese. Contributi e aggiornamenti*. Verona: MMCSN (II Serie), Sezione di Scienze dell'Uomo, 5; p. 82.

Sarti L., 2006. Presenze di vasi a bocca quadrata in Italia centrale: problemi e prospettive. In Pessina A. and Visentini P. (eds.), *Preistoria dell'Italia Settentrionale. Studi in ricordo di Bernardo Bagolini*. Atti del Convegno, Udine 2005. Udine; pp. 193-210.

Sarti L. and Martini F., 1993. *Costruire la memoria: archeologia a Sesto Fiorentino (1982-1992)*. Firenze: Garlatti e Razzai.

Sassaman K.E., 2000. Agents of change in hunter-gatherer technology In. Dobres M.-A. and Robb J.E. (eds.), *Agency in Archaeology*. London: Routledge; pp. 148-168.

Sauter A., 1963. Fouilles dans le Valais néolithique. Saint-Léonard et Rarogne. *Ur-Schweiz*, 27(1): 1-10.

Saville A., 1990. Hazleton North, Gloucestershire, 1979-82: the excavation of a Neolithic long cairn of the Cotswold-Severn group. Historic Buildings and Monuments Commission for England Archaeological Report 13. London: English Heritage; pp. 199-214..

Schiffer M.B., 1976. *Behavioural Archaeology*. New York: Academic Press.

Schiffer M.B., 1983. Toward the identification of formation processes. *AA*, 48: 675-706.

Schiffer M.B. and Miller A. R., 1999. *The material life of human beings: artefacts, behavior and communication*. London: Routledge.

Schiffer M.B. and Skibo J.M., 1987. Theory and experiment in the study of technological change. *Current Anthropology*, 28: 595-622.

Schiffer M.B. and Skibo J.M.,1997. The explanation of artifact variability. *AA*, 61: 27- 50.

Schlanger N., 1994. Mindful technology: unleashing the chaîne opératoire for an archaeology of mind. In Renfrew C. and Zubrow E.(eds.), *The ancient mind. Elements of cognitive archaeology*. New Directions in Archaeology. Cambridge: CUP; pp. 143-151.

Schlanger N., 1996. Understanding Levallois: lithic technology and cognitive archaeology. *Cambridge Archaeological Journal*, 6: 231-254.

Schlanger N., 1998. The study of techniques as an ideological challenge: technology, nation, humanity in the work of Marcel Mauss. In James W. and Allen N. J. (eds.), *Marcel Mauss: a centenary tribute*. New York: Berghahn Books, pp. 192-212.

Schlanger N., 2005. The chaîne opératoire. In Renfrew C. and Bahn P. (eds.), *Archaeology: The Key Concepts*. London: Routledge.

Schofield A.J., 1995. Artefacts mean nothing. In Schofield A.J. (ed.), *Lithics in context. Suggestions for the future direction of Lithic Studies*. London: Lithic Studies Society Occasional Papers No. 5; pp. 3-8.

Schon D.A., 1967. *Technology and change: the new Heraclitus*. New York: Delacorte.

Seeman M., 1994. Intercluster lithic pattering at Nobles Pond: a case for “disembedded” procurement among Early Paleoindian societies. *AA*, 59: 273-288.

Sellet F., 1993. Chaîne opératoire: the concept and its applications. *Lithic Technology*, 18: 106-112.

Semenov S.A., 1964. *Prehistoric Technology. An experimental study of the oldest tools and artefacts from traces of manufacture and wear*. Translated and with a preface by M.W.Thompson. London: Cory, Adams & Mackay.

Shafer H.J., 1985. A technological study of two Maya lithic workshops at Colha, Belize. In Plew M.G., Woods J.C. and Pavesic M.G. (eds.), *Stone Tool Analysis: Essays in Honor of Don. E. Crabtree*. Alberquerque: University of New Mexico Press; pp. 277-315.

Shott M.J., 1986. Technological organization and settlement mobility: an ethnographic excavation. *Journal of Anthropological Research*, 42: 15-51.

Shott M.J., 1989a. On tool class use lives and the formation of the archaeological record. *AA*, 54: 9-30.

Shott M.J., 1989b. Diversity, organization and behavior in the material record: ethnographic and archaeological examples. *Current Anthropology*, 30: 283-315.

Shott, M.J., 1996. An exegesis of the curation concept. *Journal of Anthropological Research*, 52: 259-280.

Shott M. J., 2003. Chaîne opératoire and reduction sequence. *Lithic Technology*, 28: 95-105.

Shotton F.W., Blundell D.J., Williams R.E.G., 1970. Birmingham University radiocarbon dates IV. *Radiocarbon*, 12: 385-399.

Sillitoe P. and Hardy K., 2003. Living lithics: ethnoarchaeology in highland Papua New Guinea. *Antiquity*, 77: 555-566.

Simone L. and Tinè S. (eds.), 1988. *Il Civico Museo Archeologico Platina. Guida*. Milan: Edizioni ET.

Sinclair A., 2000. Constellations of knowledge. Human agency and material affordance in lithic technology. In Dobres M.-A. and Robb J. (eds.), *Agency in Archaeology*. London/New York: Routledge; pp. 196-212.

Skeates R., 1994. Towards an absolute chronology for the Neolithic in central Italy. In Skeates R. and Whitehouse R. (eds.), *Radiocarbon dating and Italian prehistory*. Archaeological Monographs of the British School at Rome 8, Accordia Specialist Studies on Italy 3. London: The British School at Rome & Accordia Research Centre, University of London; pp. 61-72.

Skeates R. and Whitehouse R. (eds.), 1994. *Radiocarbon dating and Italian prehistory*. Archaeological Monographs of the British School at Rome 8, Accordia Specialist Studies on Italy 3. London: The British School at Rome & Accordia Research Centre, University of London.

Slimak L. and Giraud Y., 2007. Circulations sur plusieurs centaines de kilomètres durant le Paléolithique moyen. Contribution à la connaissance des sociétés néandertaliennes. *Comptes Rendus Palevol*, 6: 359-368.

Smith P., 1966 *Le Solutréen en France*. Bordeaux: Delmas.

Soressi M. and Geneste J.M., 2011. The history and efficacy of the chaîne opératoire approach to lithic analysis: studying techniques to reveal past societies in an evolutionary perspective. *PaleoAnthropology*, 2011: 334-350.

Speth J.D., 1981. The role of platform angle and core size in hard-hammer percussion flaking. *Lithic Technology*, 10: 16-21.

Spier R.F.G., 1970. *From the hand of man: primitive and pre-industrial technologies*. Boston: Houghton-Mifflin.

Stahl A.B., 2013. Archaeological Insights into Aesthetic**.** Communities of Practice in the Western Volta Basin. *African Arts*, 46(3): 54-67.

Starnini E., 1993. L'industria litica. In Pantò G. (ed.), *Archeologia nella Valle del Curone*. Alessandria: Edizioni dell'Orso; pp. 31-42

Starnini E. and Voytek B., 1997. The Neolithic chipped stone artefacts from the Bernabò Brea-Cardini excavation. In Maggi R. (ed.), *Arene Candide: a functional and environmental assessment of the Holocene sequence (excavations Bernabò Brea-Cardini 1940-50)*. Roma: MiBAC, Soprintendenza Archeologica della Liguria e Istituto di Paleontologia Umana; pp. 143-152.

Starzmann M.T., 2013. Spontaneity and habitus. Stone tool production in communities of practice at Fistikly Höyük. In Nieuwenhuyse O.P., Bernbeck R., Akkermans P.M.M.G. and Rogash J., 2013. *Interpreting the late Neolithic of upper Mesopotamia. Papers on archaeology of the Leiden Museum of Antiquities*. Turnhout: Brepols; pp. 161-169.

Stout D., Toth N., Schick K., Stout J. and Hutchins G., 2000. Stone Tool making and Brain Activation: Position Emission Tomography (PET) Studies. *JAS*, 27: 1215-1223.

Sturani C., 1964. La successione delle faune ad ammoniti nelle formazioni medio-giurassiche delle Prealpi venete occidentali. *Memorie dell'Istituto di Geologia e Mineralogia dell'Università di Padova*, 24: 1-65.

Sullivan A.P and Rozen K.C, 1985. Debitage analysis and archaeological interpretation. *AA*, 50: 755-779.

Tarantini M., 2005. Georges Laplace in Italia tra tipologismo e antitipologismo. Appunti per una riflessione storica. In Martini F. (ed.), *Askategi, miscellanea in memoria di Georges Laplace*. RSP, Supplemento 1, pp. 31-40.

Tarantini M., 2008. Tra teoria pigoriniana e mediterraneismo. Orientamenti della ricerca preistorica e protistorica in Italia (1886-1913). In *La nascita della Paleontologia in Liguria*. Atti del convegno, pp. 53-61.

Testart A., 1982. The significance of food storage among hunter-gatherers: residence patterns, population densities and social inequalities. *Current Anthropology*, 23(5): 523-537.

Terrenato N., 2005. Start the revolution without me. In Attema P.A.J,, Nijboer A. and Zifferero A. (eds.), Recent debates in Italian classical archaeology. *Papers in Italian archaeology*, *6*: 15-17.

Thomas J., 1996. *Time, Culture and Identity. An Interpretative Archaeology*. London: Routledge.

Thomas J., 1999. *Understanding the Neolithic. A revised second edition of Rethinking the Neolithic*. London: Routledge.

Tilley C.Y., 1996. *An Ethnography of the Neolithic: early prehistory societies in southern Scandinavia*. Cambridge: CUP.

Tiné S., 1972. La campagna di scavi 1972 nella Caverna Pollera (Finale). *Ingaunia e Intemelia*, XXVII (1-4): 106-107.

Tiné S. (ed.), 1999. *Il Neolitico nella Caverna delle Arene Candide (scavi 1972-1977).* Bordighera.

Tixier J., 1963. *Typologie de l'épipaléolithique du Maghreb*. Paris: Arts et métiers graphiques (Étampes, Impr. SRIP).

Tixier J., 1967. *Procédés d'analyse et questions de terminologie concernant l'étude des ensembles industriels du Paléolothique récent et de l'Epipaléolithique dans l'Afrique du nord-ouest*. Chicago: University of Chicago Press.

Tixier J., Inizan M.-L. and Roche H., 1980. *Préhistoire de la pierre taillée. 1. Terminologie et technologie*. Antibes: CREP.

Topping P., 2004. The South Downs flint mines: towards an ethnography of prehistoric flint extraction. In Cotton J. and Field D. (eds.), *Towards a New Stone Age: Aspects of the Neolithic in south- east England*. CBA Research Report 137. York: Council for British Archaeology; pp. 177-190.

Torrence R., 1986. *Production and Exchange of Stone Tools*. Cambridge: CUP.

Torrence R., 1989. Tools as optimal solutions. In Torrence R. (ed.), *Time, energy and stone tools*. Cambridge: CUP; pp. 1-6.

Trigger B., 1991. Distinguished lecture in archeology: constraint and freedom - a new synthesis for archaeological explanation. *American Anthropologist*, (n.s.) 93: 551-569.

Tringham R., Cooper G., Odell G., Voytek B. and Whitman A., 1974. Experimentation in the formation of edge damage: a new approach to lithic analysis. *Journal of Field Archaeology*, 1: 171-196.

Turri E. and Ruffo S. (eds.), 1992. *ber*. Verona: CIERRE edizioni.

Tylor E. B., 1878. *Researches into the early history of mankind and the development of civilization*. London: John Murray.

Van Pool T.L. and Leonard R.D., 2011. *Quantitative Analysis in Archaeology.* London: Wiley-Blackwell.

Vaquer J., Remicourt M. and Bordreuil M., 2012. *Les longues lames en silex au Chalcolithique dans le midi de la France entre le Rhône et les Pyrénées*. Supplément à la Revue archéologique du centre de la France; pp. 165-183.

Venzo S., 1961. *Rilevamento geologico dell'anfiteatro del Garda,* (Part II). Milano: Memorie della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano, Vol. XIII, fasc. I.

Visentini P., 2002. Il Neolitico pieno e finale. In Aspes A. (ed.), *Preistoria veronese. Contributi e aggiornamenti*. Verona: MMCSN (II serie), Sezione di Scienze dell'Uomo, 5; pp. 68-79.

Visentini P., Bernabò Brea M., Kromer B., Fasani L., Salzani L., Salzani P. and Talamo S., 2004. Premilinari considerazioni sulle ultime del Neolitico dell'Italia Settentrionale alla luce dei recenti ritrovamenti e delle nuove datazioni assolute. *Bollettino del Museo Civico di Storia Naturale di Verona*, 28: 133-146.

Visentini P., 2005. Alcune considerazioni sul terzo stile della Cultura dei vasi a bocca quadrata. In Visentini P. (ed.), *Bannia-Palazzine di Sopra. Una comunità preistorica del V millennio a.C*. Quaderni del Museo Archeologico del Friuli Occidentale 5. Pordenone: Comune di Pordenone; pp. 173-195.

Visentini P., 2005a. L'industria litica. In Visentini P. (ed.), *Bannia-Palazzine di Sopra. Una comunità preistorica del V millennio a.C*. Quaderni del Museo Archeologico del Friuli Occidentale 5. Pordenone: Comune di Pordenone; pp. 89-95.

Warde A., 2004. *Practice and field: revising Bourdieusian concepts*. Manchester: The University of Manchester Centre for Research on Innovation & Competition.

Weedman K.J., 2002. On the spur of the moment: effects of age and experience on hafted stone scraper morphology. *AA*, 67: 731-744.

Whitehouse R., 1986. Siticulosa Apulia revisited. *Antiquity*, 60(1): 36-44

Whittaker J.C., 1994. *Flintknapping: Making and Understanding Stone Tools*. Austin: University of Texas Press.

Whittaker J.C., Caulkins D. and Kamp K.A., 1998. Evaluating consistency in typology and classification. *JAMT*, 5: 129-164.

Whittaker J.C., 2004. *American Flintknappers: Stone Age Art in the Age of Computers*. Austin: Univeristy of Texas Press.

Whittle A.W., 1999. The Neolithic period, c. 4000-2500/2200 BC. In Hunter J. and Ralston I. (eds.), *The Archaeology of Britain. An Introduction from the Upper Palaeolithic to the Industrial Revolution*. Hove: Psychology Press; pp. 58-76.

Wiessner P., 1990. Is there a unity to style? In Conkey M.W. and Hastorf C. (eds.), *The uses of style in archaeology*. Cambridge: CUP; pp. 105-112.

Williams R.E.G. and Johnson A.S., 1976. Birmingham University radiocarbon dates. *Radiocarbon*, 18: 249-267.

Winner L., 1986. *The whale and the reactor: a search for the limits in an age of high technology*. Chicago: University of Chicago Press.

Wissler C., 1923. *Man and Culture*. New York: Thomas Y. Crowell.

Woodall J.N. and Kirchen R., 1999. L'industria delle pietre focaie per armi da fuoco: ricerche tra Sant'Anna D'Alfaedo ed Erbezzo. *Annuario Storico della Valpolicella*, 1998-1999: 129-158.

Yerkes R.W., 1983. Microwear, microdrills, and Mississippian craft specialization. *AA*, 4(3): 499-518.

Young D. and Bamforth D.B., 1990. On the macroscopic identification of used flakes. *AA*, 55: 403-409.

Zadeh L.A., 1965. Fuzzy sets. *Information and control*, 8: 338-353.

Zamagni B., 1998. Il Neolitico medio e recente di Castello d'Annone. In *Atti della XXXII Riunione dell'I.I.P.P.*; pp. 141-153.

Zvelebil M., Green S.W. and Macklin M., 1992. Archaeological landscapes, lithic scatters and human behaviour. In Rossignol J. and Wandsnider L. (eds.), *Space, Time and Archaeological Landscapes*. New York/London: Plenum Press; pp. 139-226.

Zvelebil M. and Lillie M., 2000. Transition to agriculture in eastern Europe. In Price T.D. (ed.), *Europe's first farmers*. Cambridge: CUP; pp. 57-92.